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and **REHABILITATION**

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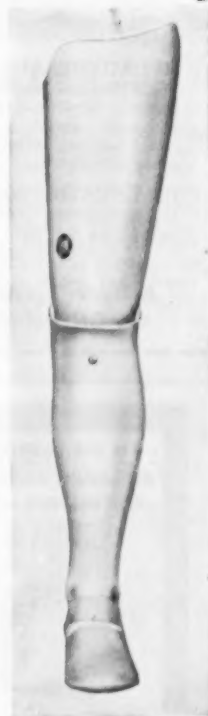
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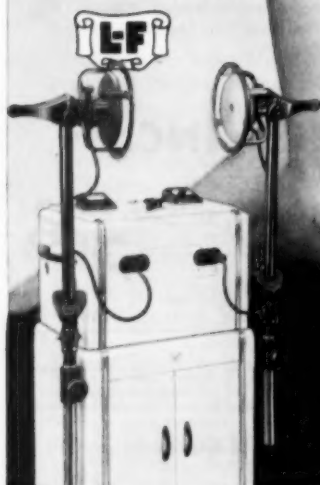
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A Study of the Relative Value of Long Wave Diathermy and Microwave Diathermy for Heating the Pelvis

Frederic J. Kottke, M.D.*
Glenn Gullickson, Jr., M.D.**
Hazel Erickson, A.R.P.T.**
Margaret Healy, R.P.T.**
Minneapolis

For many years, long wave diathermy has been used to produce intrapelvic heating for the treatment of various types of inflammatory disease.¹ The standard method of application is by means of a bare metallic intravaginal electrode and a malleable metallic belt electrode around the waist.² This method remains of value for treatment of chronic inflammation not responding to antibiotics.

Federal Communications Commission regulations concerning wavebands available for medical diathermy has made long wave diathermy obsolete. Effective methods of producing intrapelvic heating need to be developed for the diathermy machines which meet the approval of the Federal Communications Commission. Miller, et al³ reported that short wave diathermy applied externally with an induction coil or condenser pads was ineffective for intrapelvic heating. Neither was intravaginal heating using a tungsten bulb nor an Elliott rubber bag convactor considered effective.

This study was undertaken to investigate unpublished reports indicating that microwave diathermy directed over the abdomen would produce effective heating of the organs of the pelvis.

Patients referred to the Department of Physical Medicine and Rehabilitation (University Hospitals, Minneapolis) for pelvic diathermy for a number of years had been treated with a spark gap long-wave diathermy machine, using a Bier-

man metallic, vaginal electrode and a tin belt electrode three inches wide and long enough to encircle the waist. This method was used as the standard for comparison. For this study, temperatures were recorded at fifteen minute intervals from a mercury thermometer in the vaginal electrode and from an alcohol thermometer inserted three inches into the rectum. The diathermy machine was adjusted to produce a pelvic temperature of 104 - 106 F. (40.0 - 41.0 C.) for periods of one hour during each treatment. No attempt was made to produce heating above that temperature. In one group of patients, on alternate days of treatment, microwave diathermy was substituted for the long wave diathermy. The rectangular "C" director was directed at the lower abdomen centered three inches above the symphysis pubis and at a distance of four inches from the skin. Intensity of output was at patient tolerance, usually 80 - 90 per cent. Pelvic temperatures were recorded from an alcohol thermometer inserted three inches into the rectum.

Results

Thirty patients received 210 one-hour treatments employing long wave diathermy. Within fifteen minutes from the onset of the treatment, the intrapelvic temperature had risen to the desired range (40 - 41 C.). The intravaginal temperature as measured by the mercury thermometer in the vaginal electrode was about 1 C. higher than the temperature measured by the alcohol thermometer in the rectum. The mean vaginal temperature was slightly above 41 C. throughout the treatment period. The mean rectal temperature was 40 C.

Read at the Thirty-second Annual Session of the American Congress of Physical Medicine and Rehabilitation, Washington, D.C., September 8, 1954.

*Professor and Head, Department of Physical Medicine and Rehabilitation, University of Minnesota Medical School, Minneapolis.

**From the Department of Physical Medicine and Rehabilitation, University of Minnesota Medical School, Minneapolis.

throughout the treatment period (fig. 1). In every instance, the output of the

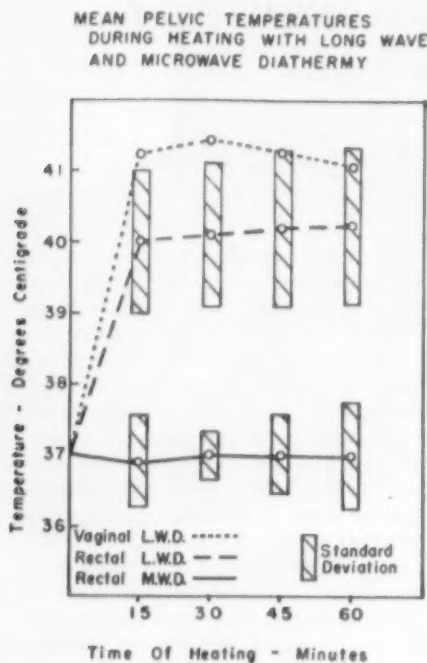


Fig. 1 — The mean pelvic temperatures recorded from the vagina and rectum during heating of the pelvis with intravaginal long wave diathermy or microwave diathermy. The vertical bars indicate the standard deviation of the series of temperature measurements at each interval.

machine was adequate to reach the desired intrapelvic temperature. It was necessary to treat one patient of the thirty at a lower than desired temperature because of pain during and subsequent to treatments. This patient was treated at 102 F. (39 C.). One patient received only two treatments because the pelvic diathermy aggravated her pain. Five other patients complained of discomfort or soreness on one or two days usually at the beginning of the treatment, but continued the treatment with good results and subsidence of their presenting symptoms. All other patients were treated as described without any discomfort.

Eight patients received microwave diathermy alternated with long wave diathermy. These eight patients received

forty one-hour treatments with microwave diathermy. The mean rectal temperature at the beginning of the treatment was 37.0 C. There was no change in the mean rectal temperature during the one hour of treatment (fig. 1). The highest temperatures recorded from the rectum at the quarter-hour intervals during treatment with microwave diathermy were 37.5 C., 38.0 C., 38.0 C., and 38.0 C. respectively. During only three of the forty one-hour treatments did the pelvic temperature show any increase and then not more than 1.0 C. The size of the standard deviation of this series of temperatures is influenced primarily by the differences in the rectal temperatures at the beginning of each treatment period.

Discussion

The development of new methods to replace methods of proved value requires that the new method be tested adequately to be sure that it is a satisfactory substitute. In the case of pelvic diathermy, it is necessary that a method for deep heating be developed which can be as easily controlled and can produce as high temperatures as can long wave pelvic diathermy. The studies of microwave heating of the muscles of the thigh⁴ indicate that it is comparable to long or short wave diathermy in its penetrability. These studies however, were made on the muscles of the extremity. The problem of heating the pelvic viscera is more difficult than that of heating extremity musculature. The extensive vascular anastomoses in the pelvis and, apparently, the high blood flow make the task more difficult. The venous drainage from the superficial areas has little influence on the temperatures of the deep viscera. There appears to be little heating by convection. No method of external heating by long wave, short wave, or microwave diathermy, has proved to be effective for deep pelvic heating. In this study it was found that microwave diathermy applied over the abdomen had no practical effect on the deep pelvic temperature.

Since long wave diathermy is now banned by the Federal Communications Commission, it is important that some effective means of pelvic heating be available to take its place. In several cases, patients were treated with short wave diathermy using a glass insulated condenser electrode in the vagina, with a condenser pad or a belt type pad over the abdomen. Several difficulties were encountered with this method. At rectal temperatures of 38 - 39 C. hot spots would develop at the vaginal electrode which were unrelieved by positioning and which prevented higher heating. Hot spots would develop around the belt electrode which had to be heavily padded. In a number of instances in the absence of hot spots, it was not possible to obtain temperatures higher than 39 C. These difficulties with this apparatus have been reported in the past.⁶

In seven treatments on one patient, short wave diathermy was applied using a bare metal vaginal electrode and an insulated belt-like condenser pad. This pad had to be spaced about two inches from the skin to avoid local heating. With that arrangement, satisfactory pelvic heating could be easily obtained and without discomfort. Rectal temperatures up to 108 F. (42 C.) were obtained (fig. 2). The temperature rose promptly at the beginning of the treatment and could be easily controlled throughout the duration of the treatment. It appeared that this method of deep pelvic heating, which has also been described previously,⁶ was adaptable to machines approved by the Federal Communications Commission and was as satisfactory in all respects as heating with long wave diathermy.

It is more difficult to prove therapeutic value for a method of heating than it is to demonstrate its heating value. It is probable that methods of heating produce much of their therapeutic effect by increasing the circulation of the blood. It has been suggested that treatment by pelvic diathermy does not require an increase of pelvic temperature to cause an increase of pelvic circulation and a beneficial effect. However, it must be re-

MEAN PELVIC TEMPERATURES DURING HEATING WITH LONG WAVE AND SHORT WAVE DIATHERMY

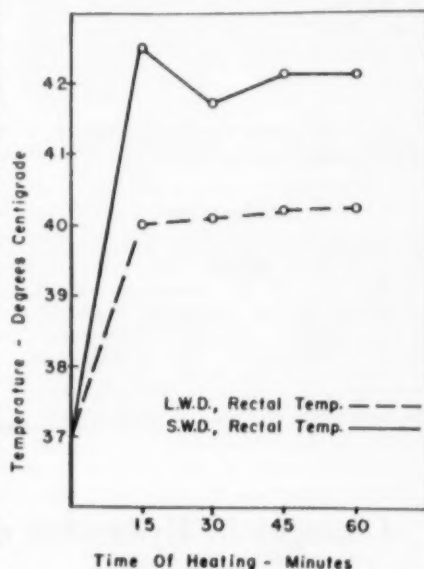


Fig. 2 — The mean pelvic temperatures recorded from the rectum at fifteen minute intervals during heating with long wave or short wave diathermy using an intravaginal electrode.

membered that the clinical value of pelvic diathermy was originally demonstrated to correlate with the increase in pelvic temperature. If athermal therapy is to be advocated, its therapeutic value must be proved by a well controlled study. In the absence of such information, all data available at the present support the assumption that methods of pelvic diathermy which do not produce a significant increase of deep pelvic temperature do not have a significant therapeutic effect.

Summary

In a series of thirty patients, a comparison was made of the effectiveness of both long wave and microwave diathermy for increasing the intrapelvic temperature. Intrapelvic temperature could be raised by long wave diathermy within fifteen minutes to 41 C. and maintained at the desired temperature level. In forty one-hour treatments with

microwave diathermy applied to the lower abdomen, there was no significant change in the intrapelvic temperature. It appears that the application of short wave diathermy using an intravaginal electrode is equally as effective as long wave diathermy.

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Changes in Hydration of Muscle and Tendon Following the Application of Ultrasonic Energy

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Denver

In studies carried out to determine the effect of ultrasound on muscle phosphocreatine (CP) there was noted, in addition to a marked decrease in CP, a slight decrease in total phosphate which could be explained most easily by assuming that there was an increase in the relative water content of the muscle after sounding.¹ Since changes in the water content of the intervertebral discs have been implicated in the improvement following the use of ultrasound in rheumatoid spondylitis,² and since changes in extensibility of tendon have been related to the degree of hydration,³ it was felt that the further investigation of changes

in the water content of muscle and tendon following the application of ultrasound was pertinent.

Method

The experiments were carried out on *Rana pipiens* for a period of five months. The frogs were kept in running tap water at a temperature of approximately 15 C. before use. After high level cord section the skin over both gastrocnemii was removed, the frog was placed in cold Ringer's solution (mean temperature 5.0 C. \pm 0.05 C.), and one gastrocnemius was exposed to ultrasound at an average intensity of three watts/cm² and a frequency of one megacycle per second for varying periods of time (Birtcher model U Ultrasound unit was used in this study). As determined by a thermistor probe, the contralateral control muscle was outside the ultrasound field.

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The distance from the sound head to the muscle was approximately one-two mm. To prevent cavitation, the Ringer's solution was boiled for fifteen minutes, cooled to the required temperature and then evacuated for ten minutes. Irradiation was performed with the frog and the sound head in vacuo. Details of the brass container in which the frog was placed are described elsewhere.¹

Although the ultrasound head was fixed in position, rectangular pulsing of the ultrasound beam with a one millisecond on period and a two millisecond off period, and gentle oscillation of the brass container prevented any rise in temperature of the muscle or the Ringer's solution, as measured by copper-constantan thermocouples and recorded with a Leeds and Northrup d-c amplifier.

Within ten seconds after completion of the sounding, the frog was removed from the Ringer's solution, a 100 mg. section (approximately) of muscle which had been in the maximal sound field and a comparable section of the contralateral control muscle was carefully dried with filter paper and weighed with a torsion balance. In alternate experiments the control and test slices of muscle were weighed first. On the average, the weighing of the muscle slices was complete within three minutes after discontinuing ultrasound. The slices were then dried to constant weight, in vacuo over P_2O_5 at room temperature.

The procedure as applied to the Achilles tendon differed only in detail from that related to muscle. For convenience in handling, the entire gastrocnemius and its tendon was removed. The tendon was placed in the zone of maximal ultrasound energy, with the contralateral muscle and tendon in the Ringer's solution at the same temperature but out of the ultrasound field. The long axis of the treated tendon was at right angles to the ultrasound field. The entire tendon was then weighed before and after the removal of water. In most experiments the distance from the sound head to the tendon was one-two mm. In a small series this was increased to four-five mm.

Results

The results are expressed as the percentage change in solids in comparison with the contralateral control gastrocnemius, the per cent solids being the $\frac{\text{Dry weight}}{\text{Wet weight}} \times 100$.

A. Normal muscle sounded in cold Ringer's solution (24 experiments—fig. 1). When the muscle was removed from the Ringer's solution within ten seconds after stopping ultrasound, it was noted that there was a small but consistent and significant, decrease in the per cent of solids in the irradiated muscle. In twenty-two of the twenty-four experiments a decrease in the per cent solids was noted; in one experiment a slight increase was present, while in another there was no change. A plateau was reached within three minutes. No further change was evident in hydration on further irradiation.

B. Normal muscle sounded in cold Ringer's solution, with removal from the solution one minute after sounding was stopped (18 experiments—fig. 1). Establishment of the plateau suggested the possibility of a steady state which might result in return to normal levels when sounding was stopped. As noted in figure 1, this proved to be true, and within one minute after sounding was stopped the degree of hydration of control and sounded muscles was approximately the same. Whether the Ringer's solution was subjected to a vacuum or to atmospheric pressure made no difference with respect to the recovery process at a temperature of approximately 5.0 C.

C. Normal tendon sounded in cold Ringer's solution (30 experiments—fig. 2). Marked and significant increase in the per cent solids was produced in normal tendon by the application of ultrasound. As with muscle, a plateau was reached, though a bit more rapidly with tendon, since maximum changes were noted within one minute after beginning ultrasound irradiation. Within one minute after cessation of ultrasound, the normal values of hydration were restored.

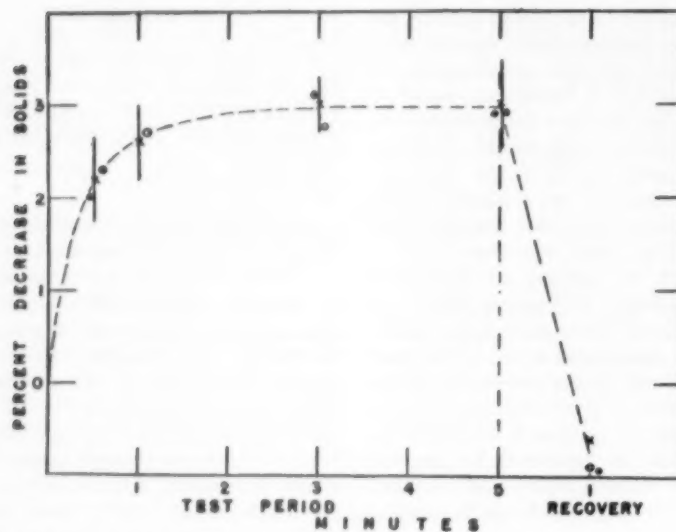


Fig. 1 — The effect of ultrasound on hydration of muscle. Sounding is stopped at the point indicated by the vertical broken line. Crosses refer to normal muscle sounded at 5 C., open circles to normal muscle sounded at 25 C., and closed circles to DNP-treated muscle sounded at 5 C. The solid vertical lines represent one standard error from the mean per cent decrease in solids.

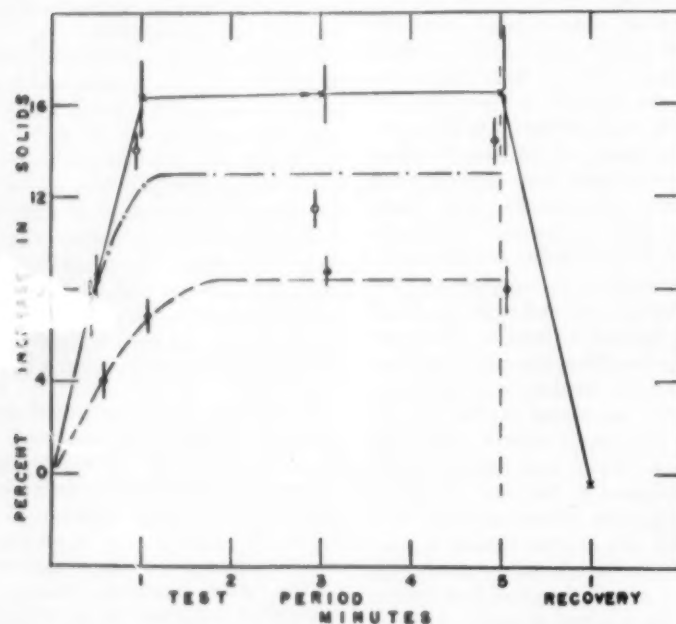


Fig. 2 — The effect of ultrasound on hydration of normal tendon. Sounding is stopped at the point indicated by the vertical broken line. Crosses refer to tendon sounded at a distance of one-two mm. at 5 C., open circles to tendon sounded at four-five mm. and 5 C., and closed circles to tendon sounded at one-two mm. and 25 C. The solid vertical lines represent one standard error from the mean per cent increase in solids.

To determine how critical the position of the tendon in the ultrasound field was in producing an increase in per cent solids, instead of the decrease noted with muscle, eighteen experiments were performed with the tendon flat on the wooden board and four-five mm. from the sound head, instead of the one-two mm. distance used in the foregoing experiments. As noted in figure 2, the change at four-five mm. was only slightly smaller than that at one-two mm. The difference between the two was not statistically significant.

Subsequent experiments were performed to study some factors which might affect the changes in water content produced by ultrasound, and thus shed some light on the mechanisms involved in these changes.

D. Muscle and tendon soaked in cold 0.5M KCl for ten minutes, then sounded in Ringer's solution for varying lengths of time (36 experiments—fig.

3). Hypertonic KCl produced a mild dehydration of the tendon, with a fourteen per cent increase in per cent solids. When ultrasound was applied to the dehydrated tendon, there was an increase in relative water content, instead of the decrease noted with the normal tendon. Maximal increases in relative water content were noted soon after sounding was started with a decrease from these high levels resulting from further sounding. It was noted that the control tendon did not significantly change in water content during the five minutes in the Ringer's solution. The treated tendon progressively increased in per cent solids as sounding was prolonged.

Muscle in hypertonic KCl showed only a six per cent increase in per cent solids. The increase in hydration with ultrasound was only slightly greater than in the normal muscle. As with tendon, the increase in relative water content was greatest early in the sounding per-

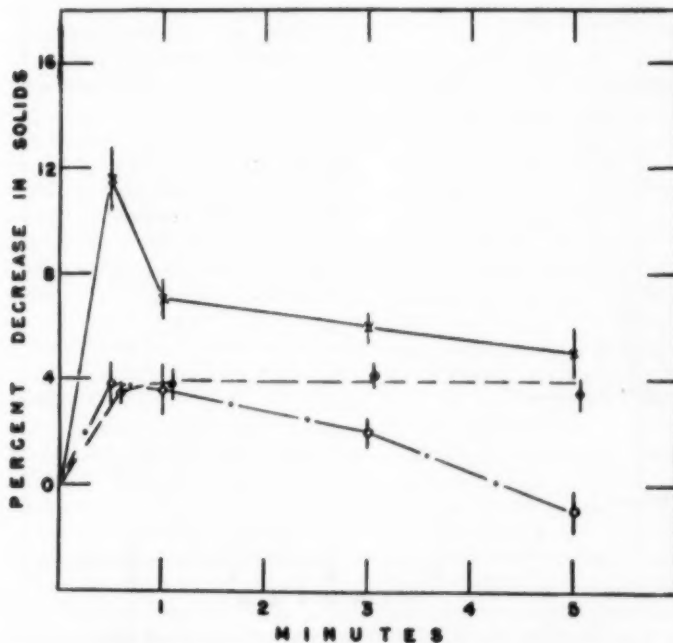


Fig. 3 — The effect of ultrasound on hydration of muscle and tendon previously treated with 0.5M KCl. Open circles and crosses refer to muscle and tendon, respectively, sounded in Ringer's solution. Closed circles refer to muscle sounded in distilled water. The vertical lines represent one standard error from the mean per cent decrease in solids.

iod. With more prolonged sounding the per cent solids increased in the treated muscle, until after five minutes, there was actually a slight decrease in hydration in comparison with the control muscle.

It was felt that this increase in per cent solids with prolonged sounding of the 0.5M KCl treated muscle—which did not occur in the normal muscle—might be the result of increased passage of salts from the medium through a muscle membrane whose permeability had been increased by 0.5M KCl. In sixteen experiments, the procedure just described in relation to muscle was repeated, except that the sounding was done in distilled water instead of in Ringer's solution. When sounding was done in distilled water (fig. 3), the increase in water content was maintained

and significant increases in hydration were produced even after five minutes of sounding.

E. Muscle and tendon treated with fifty per cent glycerol for thirty minutes before sounding (52 experiments—fig. 4). From the studies described in the previous section, it seemed as if the initial water content of the tissue were one of the factors determining the change in hydration in the ultrasound field. If this were true, then the greater degree of dehydration produced by glycerol, amounting to a fifty-five per cent increase in per cent solids for muscle and a 100 per cent increase for tendon, should result in a much greater water uptake in the ultrasound field. This was definitely true for the early stages of sounding of tendon (fig. 4). What did require further examination was the

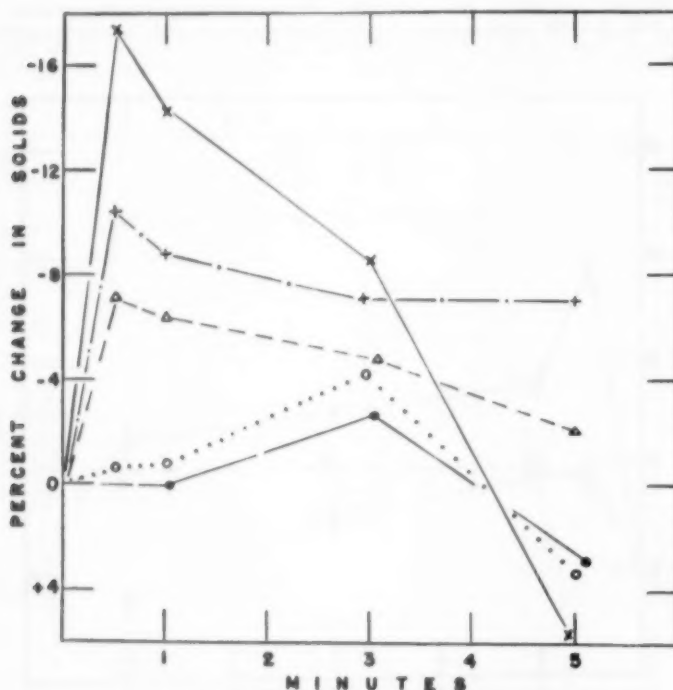


Fig. 4 — The effect of ultrasound on hydration of muscle and tendon previously treated with glycerol. Open circles refer to muscle sounded after thirty minutes in glycerol, closed circles to muscle sounded after coating with glycerol, and triangles to muscle sounded after thirty minutes in glycerol and one and one-half minute washing in 0.5M KCl; crosses refer to tendon sounded after thirty minutes in glycerol, plus signs to tendon sounded after thirty minutes in glycerol and one and one-half minute washing in 0.5M KCl.

slight change in muscle hydration during the early phase of irradiation, and the significant increase in per cent solids during the later phase of sounding, for both muscle and tendon.

As far as muscle was concerned, it seemed as if there were a barrier, probably glycerol, which prevented the entry of water until some time had passed. To test this hypothesis, in sixteen experiments the muscle was coated with glycerol, wiped, and immediately placed in Ringer's solution for sounding. This procedure did not result in any muscle dehydration during the time period concerned. Such muscles also manifested a "latent period" in relative hydration, with no change in relative water content during the first minute of sounding (fig. 4).

A final test of this hypothesis was performed with both muscle and tendon (32 experiments), with the tissue washed in cold 0.5M KCl for one and one-half minutes after the thirty minutes in cold glycerol. This procedure presumably removed or decreased the surface film of glycerol without markedly changing the relative water content of the tissue. It is noted (fig. 4) there is now an immediate increase in water content of muscle. Furthermore, there is no longer an increase in per cent solids after five minutes of sounding. It is suggested, but not proved, that the increase in solids when the unwashed glycerinated muscle or tendon was subjected to ultrasound for five minutes was due to the passage of glycerol into the tissue with prolonged sounding, and that this was prevented by the KCl bath.

F. Normal muscle or tendon sounded at room temperature (32 experiments—fig. 1 and 2). Because of the accumulating evidence relating water transport to metabolic processes,⁴⁻⁷ studies were carried out at a higher temperature than used previously. This was especially pertinent because of the previously noted effect of ultrasound on CP, a source of high energy phosphate.¹ Normal tissue was immersed in Ringer's solution, with an average initial tissue temperature of 25.5 C. The average rise in temperature

produced by ultrasound was 0.4 C. The change in muscle hydration was similar to that noted at 5 C. (fig. 1) while the increase in per cent solids in tendon was significantly smaller at the higher than at the lower temperature (fig. 2). The reason for this difference is not immediately apparent.

G. Muscle in cold 2×10^{-4} M 2,4-dinitrophenol (DNP) for fifteen minutes; ultrasound then applied in cold Ringer's solution (22 experiments—fig. 1). The effect of DNP was studied because of its action in interfering with phosphorylation mechanisms and thus interfering with water transport.⁸⁻¹¹ It is seen that neither the increase in hydration, nor the recovery process in vacuo is interfered with by the fifteen minute period in DNP. This, together with the studies carried out at room temperature, provides further evidence for purely physical factors being largely responsible for the changes in water content in the ultrasound field.

Discussion

Before proceeding any further with an analysis of the data obtained, it must be clearly understood that only relative water content changes are determined by the technic used in this study. For example, the same result can be achieved by solids leaving the muscle as by water entering the muscle. Radioactive tracer studies would aid in elucidating absolute values and directions of molecular movement. Yet, with these limitations recognized, and within circumscribed and well defined areas of thought, a certain amount of speculation is possible.

Between blood and interstitial fluid, water exchange is regulated by capillary pressure, tissue hydrostatic pressure, tissue osmotic pressure and blood osmotic pressure.¹² In this study, water exchange between the tissue (including both intra- and extra-cellular phases) and the medium in which the tissue is immersed is governed by similar factors, with the exception that ultrasonic pressure can be substituted for capillary pressure, and osmotic pressure of the medium for

blood osmotic pressure. Although tissue pressure is negligible at the outset,¹² it probably plays a more important role when the steady state is reached.

One factor which must be considered, in addition to the physical ones already mentioned, is active processes of water transport. It has been shown that tissues *in vitro* can take up water from the surrounding medium under unfavorable circumstances, such as inadequate oxygen supply at lower temperatures.⁸ On return to more favorable metabolic conditions, the tissues lose water, even in hypotonic solutions.¹⁴ It is thus suggested that the transfer of water is an active process,^{4,8} requiring the conversion of energy through high energy phosphate bonds.⁹ This is demonstrated by the increase in tissue water content produced by dinitrophenol,^{10,11} a drug that reversibly uncouples phosphorylation from oxidation, preventing phosphorylation reactions without affecting oxidation.⁸

Effects of Ultrasound

In this study interest was not focussed on the changes in water content which might be produced by anoxia, since both control and test muscles were exposed to the same conditions in this respect. What is of concern is the possible effect of ultrasound on metabolic processes which may be responsible for water transport. Decrease in creatine phosphate (CP) of guinea-pig muscle when the animal is injected with diphtheria toxin is presumably followed by an increase in the water content of muscle.¹⁸ Since ultrasound can produce a change in muscle CP,¹ an analysis directed towards this mechanism is pertinent. With this in mind, the effect of anoxia, temperature, and DNP were studied. Since neither hydration nor recovery were significantly altered by these conditions, it is presumed that physical factors predominate in determining changes in water content in the ultrasonic field.

One may thus return to the physical factors noted previously. In normal muscle there is an early attainment of a steady state of hydration in the ultrasound field. This could be the result of

an increase in tissue turgor which opposes the forces created by the ultrasound field, and thus results in a balance. Soon after the sounding is terminated, this tissue pressure results in a return to the normal state. Changes in the state of hydration of tissue and changes in the composition of the medium may, by altering tissue pressure and osmotic pressure relationships, affect the changes in water content produced by ultrasound. It is in this manner in part, that KCl and glycerol exert their effect, resulting in the production of greater increases in hydration by ultrasound. These are not, however, the sole factors. Water is not the only molecule which may be transferred by ultrasound. Larger molecules too can be made to pass through membranes.^{16,17} It seems possible that, in the muscle pretreated with 0.5M KCl, water passes into the muscle early, with a later increase in salt passage accompanied by a decrease in relative hydration. That this occurs in the KCl-treated state and not in the normal one may be due to the increase in permeability produced by KCl. Maintenance of the increase in hydration on prolonged sounding when the KCl treated muscle is irradiated in distilled water, instead of in Ringer's solution, is compatible with such a hypothesis, though it does not offer conclusive proof.

In addition to tissue pressure, osmotic pressure, and permeability phenomena, a temporary barrier factor seems to be present when glycerol coats the muscle. This is shown by the delay in hydration of the glycerol-treated muscle even when there is marked dehydration, unless one washes the muscle in KCl before sounding. Simple mechanical coating of the muscle with glycerol prevents, for a time, the ultrasonic effect.

The KCl and the glycerol treated tendon behave qualitatively similar to the muscle under similar circumstances. Normal tendon, however, decreases in relative water content, while the normal muscle increases in relative water content on exposure to an ultrasound field. It is almost as if water were squeezed out of the tendon by ultrasound. No

adequately proved explanation for this difference in behavior between muscle and tendon can be offered. Some pertinent factors may, however, be mentioned.

Although dense fibrous tissue seems only slightly pervious to water, it can take up water, and hold it, from much more hypertonic solutions than can muscle.^{19,20} The uptake of water by fibrous tissue resembles more the hydration of colloids than osmotic phenomena.²⁰ Thus, before sounding begins, the tendon has already taken up more water in the isotonic saline than has the muscle. This makes for a high tissue pressure in tendon and possible altering of the ultrasound effect. Another factor to be considered is the normal direction of passage of fluid along connective tissue fibrils in longitudinal fashion,²¹ and thus at right angles to the direction of the ultrasound application. McMaster and Parsons²¹ have shown that mechanical forces might squeeze fluid along the surface of these fibrils. Ultrasound may provide such a mechanical force. Further evidence of the importance of orientation is demonstrated by the fact that collagen is attacked by trypsin only at the cut ends of the fiber.²² Possible reasons for differences between tendon and muscle behavior with respect to hydration in the ultrasound field then exist. Which, if any, of these factors proves to be the important one can be determined only by further study.

Summary

Relative water content of normal muscle increases, while that of normal tendon decreases in the ultrasound field. These changes are reversible ones. Reasons for this difference between normal muscle and tendon are discussed.

Anoxia, temperature change, and 2,4-dinitrophenol (DNP) have little effect on the hydration changes produced by ultrasound, suggesting that purely physical factors are of major importance in controlling the water content.

The changes in water content of muscle and tendon are different when these tissues are treated with 0.5M KCl

or fifty per cent glycerol prior to sounding. The relationship of these changes to tissue pressure, osmotic pressure of tissue and medium, permeability, and the existence of barriers is discussed.

Appendix

In short duration experiments, such as those done in this study, it is not likely that a large loss of phosphate from muscle to medium would take place. If this is true, then the sum of creatine phosphate (CP) phosphorus and inorganic phosphate (IP) phosphorus should be the same in control muscle and in muscle treated with ultrasound. Yet, in the study to which reference has been made, there was a slight but significant ($p < .02$) decrease of three per cent in the sum of CP and IP phosphorus, from 607 μg per gram wet tissue to 588 μg per gram wet tissue. If this change is due primarily to an increase in hydration with sounding, then the sum of CP and IP phosphorus should be the same in control and sounded muscles, if computed on the basis of dry weight. In this study, the per cent solids decreased from 21.32 to 20.70 ($p < .01$) with exposure to ultrasound. The amount of phosphorus (P) per gram dry weight may be computed from the following formula:

$$\text{P/gram dry weight} = \frac{\text{P/gram wet weight} \times 100}{\text{per cent solids}}$$

From this it may be computed that the sum of CP and IP phosphorus in control muscle averages 2.85 mg./gm. dry weight, while in sounded muscle it is 2.84 mg./gm. dry weight. It is certainly strongly suggestive that the decrease in P noted in the previous study is almost entirely due to the increase in hydration of muscle in the ultrasound field.

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IMPORTANT NOTICE: CHANGE OF EXAMINATION DATE

AMERICAN BOARD OF

PHYSICAL MEDICINE AND REHABILITATION

The next examinations for the American Board of Physical Medicine and Rehabilitation will be held in Philadelphia, June 10, 11 and 12, 1955.

Critical Analysis of Divergent Views of Movement at the Shoulder Joint

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Atlanta, Ga.

The mechanism of the shoulder-arm complex is an intricate one and the literature of the last hundred years reveals many views as to the manner in which it functions. The humerus is capable of a wide range of movements which are largely dependent upon the relationship between the position of the scapula and that of the humerus at successive points in the arc of motion, and upon the maintenance of this shifting relationship by the differential action of the muscles affecting movements of the shoulder girdle and humerus. The purpose of this paper is to discuss, in the light of some of the concepts reported in the literature, only one aspect of the shoulder-arm complex. With due acknowledgment of the roles played by the sternoclavicular and acromioclavicular joints in movements of the humerus, discussion will be confined to analysis of movements of the scapula and humerus during elevation of the arm.

Much of the nomenclature of kinesiology is not standardized and, as Moseley¹ points out, movements of the shoulder are rarely defined. Consequently, the following brief description of fundamental positions and movements is presented for the sake of clarity.

Fundamental Positions

The term *flexion* is used to designate elevation of the arm in the sagittal plane and *abduction* for elevation in the coronal plane. When the arm has been elevated to shoulder level and is then moved in the horizontal plane, the motion is termed *horizontal abduction* and *horizontal adduction*. In the normal movements of everyday life the position of the arm at the start of elevation is not the anatomical one, and if a careful analysis is to be made of the mechanism involved in normal elevation, it is ex-

pedient to understand the position of the parts and the state of the muscles at the start of motion. When the arm hangs easily at the side, the opposing muscle groups of the shoulder-arm complex are relatively inactive. The humeral head is rotated medialward from the anatomical position and the medial condyle points slightly backward and medially. In this "at ease" position the location of the scapula is, to a large extent, determined by the shape of the rib cage upon which the shoulder girdle rests. The rib cage contour is, in turn, affected by the angle of the A-P curve of the thoracic spine since the ribs are hanging structures attached to the thoracic vertebrae. With the exception of the two extremes of body build and within the range of normal variation, the scapula lies against the postero-lateral aspect of the rib cage, has a slight downward slant due to the weight of the hanging arm, and the glenoid fossa faces about midway between the direct anterior and lateral view.

Many investigators, including Duchenne², Cathcart³, Stookey⁴, and Lockhart⁵, have established that scapular rotation occurs simultaneously with elevation of the humerus regardless of the plane of motion. The purpose of this rotation is to place the glenoid fossa, as well as other lateral parts of the scapula, in positions which allow the humerus to be raised with a minimum of limitation by adjacent bony and ligamentous structures. According to Stookey⁴, during the first 50 to 60 degrees of humeral elevation the scapula

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rotates upward about 5 to 6 degrees with what Lockhart⁸ describes as a "delicately accelerated gliding motion." Inman, Saunders, and Abbott⁹ concluded that during this beginning phase the scapula was seeking stability in relation to the humerus. Stookey's⁴ figures show that with continued elevation of the arm from 60 to 115 degrees the scapula rotates about 35 to 40 degrees, while from 115 degrees to complete elevation the extent of scapular rotation is similar to that of the first phase of elevation. Thus, when the arm is raised to complete elevation, there is seen a pattern of scapulo-humeral movement in which three phases are noted. In the first and last phases the ratio of scapular movement to that of the humerus is 1 to 12 while for the middle phase it is 4 to 5.5. The ratio for movement in the second phase, in which the greatest amount of scapular rotation occurs, indicates a markedly constant relationship between motion of the scapula and that of the humerus. Concerning this pattern of movement, Fisk and Garnet⁷ say that there is "a well coordinated scapulo-humeral rhythm" during both flexion and abduction; the results of Inman and his co-workers⁹ indicate that, although the pattern of scapular movement in the first and third phases was variable from individual to individual, it tended to be characteristic for each individual; while in the middle stage scapular motion was markedly consistent for all cases studied. It is generally recognized today that if this scapular rotation is interfered with in any manner, normal elevation of the humerus will be affected. When the arm is abducted to the vertical position the scapula rotates around a relatively stable axis with, perhaps, some slight movement toward the vertebral column. On the other hand, when the arm is flexed the scapula glides forward around the rib cage as it rotates. It is to be noted that its position at the end of complete flexion is the same as at the end of complete abduction which means that, at some point during the latter half of flexion, the scapula moves back toward the spine.

It is also well established that when the arm is elevated to the full vertical position, again regardless of plane of motion, the humerus must rotate laterally if free movement is to be achieved. It seems to be a somewhat general opinion that if this rotation does not occur the greater tuberosity of the humerus will come into contact with the acromion process and this obstruction will limit the movement. However, there is disagreement with this hypothesis. Lockhart⁸ states in agreement with Moseley¹ and Johnston⁶, that x-rays did not show this restriction and he (Lockhart) feels that abduction of the arm is checked by the tightening of the inferior part of the capsule. According to Martin⁵, the greater tuberosity comes in contact with the lateral edge and under surface of the acromion process and the coracoacromial ligament during the latter half of abduction, and lateral rotation allows the greater tuberosity to slide under the acromion. Martin⁵ believes that this lateral rotation is not due entirely to muscle action since it occurs when the humerus is lifted passively. This action can also be noted when the arm of a properly prepared cadaver is raised. Although it is apparent that the issue of *why* and *how* the lateral rotation occurs is still controversial, it may be accepted for the purpose of functional analysis, that rotation is necessary since some resistance, either ligamentous, tendinous, cartilaginous, or bony, will be encountered if it does not take place.

Muscle Grouping

In view of the preceding discussion it is now logical to group the muscles chiefly responsible for elevation of the arm into three classifications—those which rotate the scapula upward; those which act directly to lift the arm, and those which rotate the humerus laterally.

The trapezius and serratus anterior, which are large and extensive muscles, are the upward rotators of the scapula. Even a superficial study of the alignment of the trapezius suggests a division into four functional parts and, although there is no disagreement as to the many

actions of its fibers, only a few investigators have considered the differentiation of function of the parts as well as the overall action of the muscle. Since it also has an extensive innervation, it is of particular importance that one should distinguish the functional parts and their actions. It is of interest to note that the most definitive studies of this muscle were performed by Duchenne⁸ in the middle of the nineteenth century; by Wright¹⁰ in the early part of the twentieth century, and by Wiedenbauer and Mortensen¹¹ in the middle of the twentieth century. It is of further interest to us that the work of the last pair has substantiated the results of the earlier two investigators. According to the electromyographic work of Wiedenbauer and Mortensen¹¹, all parts of the trapezius are active during both flexion and abduction of the humerus. They are most active during the latter half of these movements when the magnitude of scapular rotation is greatest. The acromial and lower sections of the muscle are better aligned for upward rotation than are the other two parts. The fact that in these studies they showed higher action potentials than did the clavicular and horizontal fibers is to be expected. The horizontal fibers, along with the rhomboids, act primarily to stabilize the vertebral border of the scapula against the ribs. Wiedenbauer and Mortensen¹¹, as well as Inman, Saunders, and Abbott⁹, found that all four parts are more active for abduction than for flexion of the humerus. This is logical since, in the latter movement, the trapezius must relax somewhat to allow the scapula to move forward around the thorax. Moseley¹ points out that if paralysis of the trapezius occurs early in life, the serratus can be developed to carry the burden of scapular rotation necessary for humeral elevation.

The other upward rotator of the scapula, the serratus anterior, lies on the antero-lateral aspect of the rib cage and it is the lower five or six bands, which slant upward and laterally to insert on the lower end of the vertebral border of the scapula, that have upward rotation

action; while all the fibers are aligned to abduct the scapula away from the spine. Therefore, as the work from Inman's⁹ laboratory shows, the serratus is more active for flexion than for abduction of the humerus. Serratus paralysis is more serious than paralysis of the trapezius for, without the aid of the serratus it is difficult, if not impossible, to elevate the arm above 100 degrees.

The muscles which act directly to lift the humerus are the deltoid, pectoralis major, coracobrachialis, and supraspinatus. Of these, the powerful tri-part deltoid is the chief elevator. Certain movements for which it comes into play are obvious. The anterior portion is a strong flexor; and the middle deltoid, with the lateral fibers of the posterior part, is well aligned for abduction. Although the posterior deltoid is active during elevation, the degree of its activity, as shown by the electromyogram, is less than that of the anterior and middle deltoid. Most authorities believe that its function is both a guiding and stabilizing one. Controversy concerning the role of the deltoid as an elevator revolves around three questions: 1) does the deltoid function at the beginning of elevation and can it initiate the movement; 2) does it work for elevation beyond the horizontal, and 3) at what point in elevation are the fibers most active.

The best of the electromyographic studies show that all fibers are active from the beginning of both flexion and abduction. That the deltoid *can* initiate abduction is shown in those clinical cases where the supraspinatus, thought by many to be necessary for initiation of the movement, is paralyzed; while Inman, Saunders, and Abbott⁹ report that action potentials showed the supraspinatus did not initiate abduction although it worked with the deltoid throughout the range of motion.

The concept that the deltoid lifts the arm only to the horizontal is an old one despite the fact there has been little direct evidence to support it. The work of Stookey⁴, the studies of Inman, Saunders and Abbott⁹, and the results of Yamshon and Bierman¹², as well as

others, show conclusively that not only does the deltoid function throughout elevation in any plane, but during the latter half of such movement it acts strongly. These same investigators also provide evidence on the third controversial point dealing with the quantitative activity of the muscle during elevation. There is a steady rise of action current potentials to a high level by the end of the first 100 degrees of elevation and, as the arm moves to complete elevation, activity in the muscle continues at peak level. Paralysis of the deltoid is, of course, serious from a functional standpoint; but Moseley¹ says that, where paralysis is permanent, it is possible to develop the supraspinatus and other elevators to take over for complete abduction, although the force of the movement will be greatly diminished.

The clavicular fibers of the pectoralis major are direct flexors of the humerus, and they reach a relatively low peak of activity at about 120 degrees of elevation, after which their action current potentials decrease to zero during the latter part of the arc of motion. Steindler¹⁰ states that these fibers also act for abduction of the arm above the horizontal level. The work of Wright¹⁰ and the more recent and objective studies of Inman, Saunders, and Abbott⁶ show that no portion of the pectoralis major is active for abduction.

There is no controversy over the function of the relatively simple coracobrachialis. It is a direct flexor of the arm but its size precludes the possibility that it can substitute effectively if the other flexors are paralyzed. The muscle is not aligned for straight abduction but it will function if elevation is performed through a plane anterior to the coronal plane.

Some texts consider the biceps as a weak elevator of the arm—the long head functioning for flexion and the short head for abduction. Although Wright¹⁰ could find no evidence to support this view, Bierman and Yamshon¹⁴ report activity in the biceps after flexion or abduction was initiated. A careful study of the alignment of the biceps

would indicate that the function of this activity during elevation is to steady the head of the humerus in the joint cavity by a pull along the long axis of the bone rather than to contribute directly to either flexion or abduction. The more definitive investigations do not support the inclusion of the biceps as a direct elevator of the humerus.

Through the years the role of the supraspinatus in movements of the humerus has been the subject of much debate. There is no question now that it is active throughout the range of movement when the arm is either flexed or abducted, but the purpose of this activity has not been fully agreed upon. The alignment of its fibers across the superior aspect of the glenohumeral joint, and its short lever arm lead to the presumption that its chief role is to assist in holding the head of the humerus in the glenoid fossa during all movements of the arm and particularly during abduction. This view is accepted by many authorities and is, in all probability, correct. But it has been found, as Duchenne⁸ pointed out, that the muscle is more powerful than one would suspect. Moseley¹ states that in permanent deltoid paralysis it is possible for the supraspinatus and other muscles to take over for complete abduction. As has already been shown, the muscle is not necessary for the initiation of abduction.

Lateral rotation of the humerus, which must accompany normal elevation of the part, is unquestionably accomplished by the infraspinatus and the teres minor. Many authorities, among them Martin⁹ and Moseley¹, include the supraspinatus among the lateral rotators, but this action does not seem consistent with the alignment of its fibers unless the arm is first placed in extreme medial rotation. It is more probable that the purpose of its activity during flexion and abduction is to stabilize the humeral head in the joint cavity. Since the infraspinatus and the teres minor, like the supraspinatus, insert high on the humerus, they too serve to hold the head of the humerus in the glenoid fossa.

As a muscle active during elevation of

the humerus, the teres major presents an interesting problem and is an excellent example of the intricate coordination of muscle action involved in movement of body parts. Since the position and alignment of the muscle indicates that the teres major extends, adducts, and inwardly rotates the humerus, and since clinical findings confirm these actions, it would be natural to assume that the muscle must be an antagonist to abduction of the arm. However, cases of isolated teres major paralysis have been reported where abduction is limited and difficult; while the results of Inman, Saunders, and Abbott⁶ showed that the muscle became active when the arm was held at any point during abduction, and was most active if the arm were stationary within the arc of the middle phase. In the light of the scapular rotation which takes place when the humerus is abducted, the explanation given by Inman⁶ and associates for this activity is entirely consistent. With the humerus stationary at any point in abduction, the force of the contracting teres major is exerted on the scapula and thus the muscle helps to stabilize that structure in the necessary rotated position.

This paper has presented a comparative analysis of a number of views reported in the professional literature published in the last century dealing with scapulo-humeral movements occurring when the humerus is elevated. No attempt has been made to include discussion of the influence of articular structures of the total shoulder-arm complex, the changing leverage of moving bones, the synergistic and stabilizing function of all muscles involved in elevation of the part, nor the theoretical force requirements so well presented by Inman, Saunders, and Abbott⁶.

Conclusions

In the light of the various reports studied and within the imposed limitations of the paper, the following general conclusions concerning elevation of the upper extremity may be drawn:

A fairly consistent pattern of scapular rotation occurs for both flexion and ab-

duction of the humerus and, if for any reason, this pattern is altered, free and full elevation of the extremity will be restricted or modified.

Unless the humerus is rotated laterally during elevation, the humeral head will come into contact with some obstruction and the range of elevation will be limited.

Present knowledge of the intricate coordination of muscles acting to produce elevation of the arm is consistent with the pattern of scapular and humeral rotation which occurs when flexion or abduction of the extremity is performed.

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Management of Degenerative Joint Disease of the Knee

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Physicians often comment that they have difficulty in gaining patients' interest and cooperation in the treatment and care of their degenerative joint disease even though considerable time and effort has been spent in planning a good program of treatment. It is inadequate to explain this difficulty on the basis that most of these patients are in an older age group. It is possible that this lack of interest and cooperation may be due in part to the physician's attitude. He often lacks enthusiasm and optimism when he presents the plan of treatment to the patient. There is sufficient reason for this attitude for, as a physician he knows that articular cartilage has physiologic limitations in its ability to repair itself, so that anatomic cure of degenerative joint disease is not possible. Many doctors begin their preliminary discussion with the patient who has degenerative joint disease by reminding him, "This is something you have to learn to live with."

If this attitude of resignation and palliation toward degenerative joint disease is to be changed, then we must determine what reasonable goals can be set for the patient. Can he be assured of having pain free joints, with limited use, if he follows a recommended treatment regimen such as that already well outlined in papers by Short and Bauer¹ and also by Bayles?² Is it true for an important weight bearing joint like the knee that the stability of the joint depends more on strength of surrounding

musculature than on ligamentous structures as pointed out as a general principle of joint function by Selke?³ Is it possible in a knee joint with marked ligamentous instability to restore its full functional stability by hypertrophy of the quadriceps as described by DeLorme and Watkins?⁴ It is the purpose of this paper to answer these questions and to show that the outlook can be optimistic for degenerative joint disease of the knee, even in advanced stages with marked instability.

Case Reports

Case 1: A.G., age 75, white, female, came to the clinic with complaints of pain and swelling in the knees. She had had knock knees for as long as she could remember. These were never painful until after a fracture of the right femur thirteen years previously. Ever since then there has been a gradual progression of the genu valgum deformity of the right knee, plus pain and swelling of both knees which gradually became worse. Examination revealed moderate effusion and weakness of quadriceps in both knees, which was more marked on the right. Ligamentous instability was only mild in the left knee but, moderately severe in the right knee. Motion was good in both knees with no flexion contractures. There was three-fourths of

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one inch shortening of the right lower extremity, presumably due to the old fracture. No pain on motion, no tenderness, nor any other indication of acute inflammatory reaction in the knee joints was evident. Roentgenograms revealed degenerative joint changes of both knees with marked narrowing of joint space. The right knee exhibited greater narrowing of joint space. Diagnosis made was degenerative joint disease of both knees resulting from mechanical strain of congenital genu valgum and shortening of the right lower extremity.

Treatment consisted of applying a lift to the right shoe and instructing the patient in a home program of infrared heat and massage for the knee, to be followed by progressive resistance exercises for strengthening both quadriceps. She was advised to reduce the amount of activities which required her being ambulatory. A recheck, seven weeks later, revealed improvement in the left knee. However, the right knee had become weaker and more painful because the patient did not reduce her activities. She was admitted to the hospital and placed on bed rest with local application of heat and massage to the right knee. By the fourth day, the right knee was pain free.

It was so weakly supported that progressive resistance exercises for strengthening the weak quadriceps could not be performed in the usual manner by hanging weights on the foot. A pulley mechanism was used similar to the arrangement on an Elgin exercise table. It required two weeks for the right quadriceps to become strong enough to extend the knee against gravity through its full range of motion. At this point, crutch walking with partial weight bearing on the right leg was inaugurated. During ambulation the right knee was supported with an elastic bandage. Walking was permitted for short periods of three to five minutes five times daily. On the twentieth day after admission, synovial effusion had subsided. The patient was dismissed with instructions relative to a carefully detailed program of treatment and limited activities at home.

As strength in the quadriceps improved, walking with crutches gradually progressed by increasing the number of periods the patient was allowed to be up and about. By restricting the duration of each period of ambulation within the tolerance of the right knee joint, recurrences of symptoms in this joint were avoided. No pain in the knees was pres-



Fig. 1 — Roentgenograms of right knee (Case 1) showing amount of lateral motion allowed by ligamentous instability when the quadriceps is relaxed.

ent since the fourth day in the hospital. The patient returned at regular monthly intervals for rechecks and aid in the regulation of her activities and home treatment program.

It required more than one year to gain sufficient strength and muscular stability in the right knee to discontinue crutches and start full weight bearing on the right lower extremity. Although she still gives some consideration to the right knee by avoiding long walks or long periods on her feet, the patient has returned to her former mode of life. Figure 1 shows the amount of ligamentous instability which still persists in the right knee. In spite of this, any attempts by the examiner to produce passive lateral motion in the knee can be prevented by tightly contracting the quadriceps. Thus, she is able to walk without pain in this knee because it can be completely stabilized with the hypertrophied quadriceps.

Case 2: E.B., age 50, white, female, who has congenital achondroplasia, was admitted to the hospital on June 24, 1952, for treatment of acutely painful knees. As often happens in joints with achondroplasia, there was a history of

numerous episodes of locking and difficulty with loose bodies in the knees. Surgical removal of loose bodies from the left knee had been performed twice—thirty-eight years ago and thirteen years previously. Two episodes of what was considered to be acute rheumatoid arthritis had involved both knees. The first time was four years prior to admission, and the second time was two years prior to admission. Ever since the second episode, the knees had gradually become more painful, weak, and disabled. The patient was unable to walk two weeks prior to admission. Roentgenograms of the right knee (fig. 2) made at time of admission, show marked hypertrophic changes with narrowing of the joint space and multiple loose bodies. Mild flexion contractures of both knees were evident. Synovial thickening and effusion was marked in both knees. Lateral instability was moderate in the left knee, marked in the right. Both quadriceps groups were so weak that neither could extend the knee against gravity. Although there was a suggestion of continued activity of rheumatoid arthritis by an evaluation in the sedimentation rate and morning aching and stiffness



Fig. 2 — Roentgenograms of right knee (Case 2) showing degenerative changes with loose bodies and narrowing of the joint space.

in the shoulders, there was a rapid disappearance of the inflammatory reaction in the knees.

Treatment included bed rest, aspirin, and daily physical therapy consisting of generalized radiant heat, massage to the knees, and stretching exercises to correct flexion contractures. After the inflammatory response had subsided and flexion contractures were corrected, an additional three weeks of daily exercises was required for the quadriceps to gain enough strength to start progressive resistance exercises for strengthening these muscles in the usual manner. Walking with crutches was not started until flexion contractures had been corrected and was kept at a minimum of only a few steps between bed and wheelchair, between wheelchair and bathroom, until considerable improvement in strength of the quadriceps had been made. At the time of dismissal from the hospital, the right quadriceps was able to lift one pound while the left was able to lift three pounds.

Eight months of slow but steady progress on a program of home treatment was necessary before there was enough stability in the knees, by virtue of increased strength in the quadriceps,

to enable this patient to discontinue use of the wheelchair and rely on crutch walking for her only means of ambulation. After another four months, ligamentous instability in the knees remained the same, but hypertrophy and increased strength in the quadriceps was sufficient to prevent any lateral motion of the knees. At this point the patient found she could walk without crutches and without pain in the knees if she limited the distance to 100 yards or less, or was ambulatory for periods of no longer than ten minutes. If this time or distance were exceeded, she did experience a beginning of mild discomfort in the right knee. This pain served as the signal to stop, rest, and discontinue weight bearing on this joint. At this time, the patient had reached a ten-repetition-maximum of thirty pounds. After once gaining good muscular stability in both knee joints, there was no longer any difficulty with sudden locking due to the loose bodies in the knees. It appeared that this would be a logical point to discontinue progressive resistance exercises for the quadriceps, but the patient indicated a willingness to continue. When the ten-repetition-maximum reached thirty-five pounds, she



Fig. 3 — Roentgenograms of right knee (Case 2) showing amount of lateral motion allowed by ligamentous instability when the quadriceps is relaxed.

found she could make an appreciable increase in the distance she could walk or the time she could be on her feet without discomfort in the knees. When a ten-repetition-maximum of forty pounds for each quadriceps was attained, she found, by trial and error, that walking could be practically unlimited. She has resumed a very active life as a newspaper reporter. The amount of lateral instability still present in the right knee is demonstrated in figure 3. This can be prevented by a strong contraction of the hypertrophied quadriceps even when the examiner makes a firm attempt to produce passive lateral motions manually.

Comment

Essential for the success of an extended home program of treatment for degenerative joint disease is a thorough understanding by the patient of the plan of treatment and the reasons for it. This understanding develops through discussions with the physician at frequent recheck visits. Following are general principles on which these discussions and the general plan of treatment are based.

A. Relief of pain and inflammatory reaction: It often requires bed rest of only a few days, and rarely more than two weeks, for pain and inflammatory reaction of degenerative joint disease to subside. Aspirin and local application of heat and massage help hasten this relief.

B. Correction of contributing mechanical factors: Following heat and massage, exercises should be performed which are directed toward the correction of flexion contractures and strengthening of supporting muscle groups. In the knee, the strength of the quadriceps plays an important role in the function and stability of the joint. When indicated, surgical correction of torn cartilages and loose bodies should be considered. Lifts on shoes, arch supports, and other similar orthopedic adjustments should be made to correct mechanical stresses before ambulation is resumed. Reduction diets should be started for those patients who are overweight. Obesity may be one of the most

pronounced aggravating factors in degenerative joint disease.

C. Ambulation with supports: It is important that strengthening exercises progress smoothly and are well tolerated by the joint before weight bearing activity on that joint is started. The contributing factor of ligamentous instability of the knee joint may be partially lessened by the application of a properly wrapped elastic bandage. Weight bearing joints such as the knee should be protected from full weight bearing by supporting part of the weight on the hands with crutches or canes. Ideally, these supports should be continued until all contributing mechanical factors are as fully corrected as possible. This helps prevent recurrence of pain with use of the joint. Patients with degenerative joint disease are less likely to reject the use of crutches and canes if they realize that their use is only temporary and can be discontinued when they have attained certain goals.

D. Limitation of activities: After pain and inflammatory reaction have been relieved, the joint may tolerate weight bearing activity even though contributing mechanical factors have not been fully corrected. The total amount of supported weight bearing activity a joint may tolerate without recurrence of pain or inflammation may amount to several hours daily if this activity is divided into many short intervals interspersed with rest periods. The patient is repeatedly reminded that the involved joints will tolerate better several short periods of supported weight bearing activity than a few long periods. Frequent guidance from the physician is needed to enable the patient to establish a balance between rest and limited activity. This balance should be carefully controlled so that the joint is never allowed to become painful or inflamed once again. The use of aspirin at this stage of treatment appears contraindicated for it may mask the signal of discomfort in a joint warning the patient that present activity should be discontinued. A reclining position with the feet raised is preferable for resting the knee. Over-

fatigue of weak muscles which are undergoing strengthening exercises must be prevented. When progress with progressive resistance exercises for strengthening the quadriceps begins to level off, it is often due to over-activity producing fatigue in the quadriceps, although these activities may have produced no pain in the joint. Further limiting of weight bearing activities then often permits more rapid progress of strengthening exercises.

Conclusion

Interest and cooperation of the patient in the management of his degenerative joint disease may be enhanced when the physician can offer a goal of limited but pain-free use of the involved joints. Even in cases of degenerative joint disease of the knee with marked ligamentous instability and extensive damage of the articular surfaces, it is possible to regain functional stability of the joint by hypertrophying the quadriceps. This goal can be achieved through

a progressive program of first alleviating the pain and inflammatory reaction and correcting the contributing mechanical factors before permitting ambulation with supports. Finally, limitation of ambulation and supports is decreased as strength and stability of the joint is attained.

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Residency Training Program in Physical Medicine and Rehabilitation

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Introduction

There is abundant evidence that the discipline of Physical Medicine and Rehabilitation is rapidly assuming the status of an accepted specialty comparable to the older, more established medical specialties. With continuing progress in medical education, an ever increasing demand is becoming manifest for training in this field, for American as well as foreign trained physicians. Community, hospital and medical school demands for physicians trained in this field are insistent, and probably will become more so in the near future with the anticipated greater emphasis being placed on rehabilitation by State and Federal agencies. As a result, the number of training programs in this field is expanding. With this in mind, it was thought of advantage to describe one such residency training program that has been in operation since 1947 at the New York University-Bellevue Medical Center. In this paper, no attempt is made to delineate a comprehensive four-year undergraduate medical student teaching program which has been evolved concomitantly.

It should be understood at the outset that no pretense is made that such is a universally optimum program since local conditions can easily necessitate variations.

In order to conform with the other specialties, it is believed essential that the minimum required period of three years of full-time training after an approved, and preferably rotating type internship of at least one year be maintained. Physicians trained at the residency level in other acceptable closely related specialties may require less time.

The general purpose of training should be to prepare good physicians with a comprehensive knowledge of the technical skills which a specialist in the field of Physical Medicine and Rehabilitation is expected to know. To this end, and in keeping with the traditional philosophy of the other specialties, the resident's program should encompass as an important part of his training, an increasing responsibility under proper supervision, for patient care. The final or third-year senior residency would allow the candidate actual administrative and medical experience in operating a service, assignment of junior residents and fellows, as well as participation in teaching activities.

Selection of Residents

Residents should be selected on a competitive basis with due regard given such factors as medical education (i.e., approved medical school), recommendations, licensure or eligibility therefor, personality and caliber of work in the internship period. While a serious attempt is made to consider these factors for foreign physicians, it is obvious that this may not strictly apply in every instance. These physicians should be accepted for training, where otherwise qualified, since the need for trained physicians in foreign countries in this specialty is critical. For obvious reasons, these candidates should have a reasonably good command of the English language.

Read at the Thirty-second Annual Session of the American Congress of Physical Medicine and Rehabilitation, Washington, D.C., September 8, 1954.

From the Department of Physical Medicine and Rehabilitation and Institute of Physical Medicine and Rehabilitation, New York University-Bellevue Medical Center, New York City.

Because of the diverse backgrounds of the physicians who have presented themselves for training, and because of specific individual requirements for Board examination preparation as well as other considerations, great flexibility has been required in the establishment of individual training programs. Candidates of heterogeneous backgrounds have presented themselves with requirements of from one to three years of formal training before being considered eligible for Part I of the examinations given by the American Board of Physical Medicine and Rehabilitation. Some of these have had from one to two years of training in other centers. Because of this, considerable variation has been necessary in establishing a given individual's program.

Prospective candidates make formal application for residency training. In addition, three letters of recommendation are required from previous chiefs of service or medical educators who have had an opportunity to observe the candidate beforehand. The completed application is then reviewed by a departmental Selection Committee and appointments are made on a competitive basis. Appointments are usually begun in January or July.

Training Program

In accordance with the practice of other established specialties, formal instruction in the principles and practices of Physical Medicine and Rehabilitation for the trainee should include lectures, clinical case presentations, seminars, in-patient bedside teaching, out-patient attendance and responsibility for patient care and management under competent supervision. Active participation in Journal Club activities should be required to give the resident an opportunity to become acquainted with the literature in this field. The resident should also be taught the theory and practice of electrodiagnostic technics and given the opportunity, under supervision, to use these methods in clinical practice.

In addition to didactic and clinical work with adult patients, the trainee

should have the opportunity to work with disabled children. In this Department, there is also an opportunity to work in a number of affiliated hospitals, with a large variety of adult material, such as acute, chronic, geriatric and out-patient. (The patients may be on City hospital affiliated services, referrals from private physicians, as well as from insurance carriers, other agencies and the Division of Vocational Rehabilitation). The availability of this variety of clinical material makes it desirable to rotate the trainee, within certain limitations, through the various services, including the children's and electrodiagnostic services for intervals of three to six months.

Lectures

The resident's actual training program begins with an introductory series of lectures and practice sessions concerned with basic concepts of kinesiology. These sessions elaborate functional anatomy and kinesiology of the various extremities, back and hip. In conjunction with these lecture-demonstrations, the trainee undertakes supervised practice sessions of functional muscle testing. Concomitantly, dissections of the arm and leg on the cadaver are performed in the laboratories of the Anatomy Department of the College of Medicine. This phase of training is integrated into the first-year undergraduate teaching program of the Medical College. Other basic science courses are available to the resident in the Postgraduate Medical School of New York University.

In-service Training Sessions

Weekly two-hour in-service training sessions are held for the entire residency staff during which, among others, material such as electrophysics, electrophysiology, electromyography, ultraviolet and ultrasonic therapy, history and scope of rehabilitation, physical agents in the treatment of fractures, specific indications for the use of physical agents, rehabilitation in arthritis, management of the genito-urinary system during rehabilitation, occupational therapy, mechanics of normal and pathological gait,

review of low-back syndrome, speech and hearing rehabilitation, workmen's compensation and rehabilitation, paralytic scoliosis, training of upper and lower extremity prostheses, theories of dyskinesia, functional significance of spinal cord levels and peripheral vascular disease and rehabilitation is considered.

Journal Club

In addition, bi-weekly Journal Club meetings are conducted by the residents at which time the following subjects are discussed: Muscle re-education and support in convalescent poliomyelitis; clinical problems in neuromuscular physiology; classification of the arthritides with a practical approach in Physical Medicine and Rehabilitation; prosthetic devices; the problem of the cardiac in rehabilitation; phantom limb phenomena; shoulder-hand syndrome, and spinal cord injuries with some aspects of management.

For the resident, the Journal Club sessions are of great value. In addition to becoming familiar with the literature, he is afforded the opportunity to present his review material to the staff of the Department for active discussion.

Patient Care

Under direct supervision, the resident is charged with the responsibility of patient care on the wards and out-patient services. Upon admission, a complete social, vocational and medical history is taken and patients are examined by the resident. The patient is then presented to the entire staff at evaluation clinics, both medical and nonmedical. Requisite diagnostic studies, as well as consultations, are obtained as indicated before presentation. Training programs are outlined by the resident with review by the attending staff. The patient is then followed frequently by the resident throughout his training program with periodic re-evaluation by the combined staff. In conjunction with patient care responsibility, the resident also attends back, brace, amputee and shoulder clinics. Attendance at patient presentation psycho-social conferences given by staff

psychiatrists and ancillary staff is also included in the training program.

The resident, if on a full three-year program, is in addition, rotated through the Orthopedic Surgical Service of Bellevue Hospital where he spends three months under the direction of that Department. Similar periods are spent on the Children's Rehabilitation Service. This service is an integral component of this Department which operates a group of children's beds at Bellevue Hospital as well as at the Institute of Physical Medicine and Rehabilitation.

In an attempt to broaden the resident's outlook, periods of two to three months of work may be scheduled in other institutions away from this Department. Trainees are allowed to attend short courses at other clinics in selected instances if this is feasible and can be effected without compromising patient care. They are encouraged to attend meetings of the local societies in the field of Physical Medicine and Rehabilitation and related specialties, the annual session of the American Congress of Physical Medicine and Rehabilitation and to undertake research if they are so inclined.

Patient care on the wards and at the bedside for the resident is supervised by qualified attending rehabilitation specialists. On the public wards, there is a staff of qualified internists who is integrated with the Third New York University Medical Division of Bellevue Hospital. This group makes regular attending rounds and is concerned with teaching the resident basic general internal medicine where it is applicable to rehabilitation. Staff consultation is available in all the other medical specialties, including neurology and orthopedic, neurological, general and plastic surgery.

Summary

The purpose of this program is to develop an individual with a diversified background in medicine, who can work with other members of a team and who is competent in the general principles

and practices of rehabilitation medicine. As an aid to this end, the compilation of a training manual for resident physicians has been started which, along with a series of already published manuals by this Department, it is hoped will afford

a study and reference source for the physician in the field of Physical Medicine and Rehabilitation.

For reprints, write Dr. Benton, Institute of Physical Medicine and Rehabilitation, New York University-Bellevue Medical Center, 400 E. 34th St., New York 16, N.Y.

MEDICAL NEWS

Members are invited to send to this office items of news of general interest, for example, those relating to society activities, new hospitals, education, etc. Programs should be received at least six weeks before the date of meeting.

In Memoriam

Dr. Gerhard S. Wickler, 49, of Indianapolis, died November 18, 1954, of coronary occlusion with myocardial infarction. During World War II, Dr. Wickler served at the U. S. Army Tuberculosis Hospital at Fort Bayard, New Mexico. In 1951, he moved to Outwood, Kentucky where he worked in a veterans hospital. He had been on the staff of the VA Hospital at Indianapolis since June, 1953. Dr. Wickler was a Congress member and was recently certified by the American Board of Physical Medicine and Rehabilitation. He was a member of the American College of Chest Physicians and the American Medical Association. Surviving him, is his wife Edith.

Dr. Ignaz Spielberg, 53, of Sunmount, New York, died on September 12, 1954 at Harrisonburg, Virginia. Dr. Spielberg, a Congress member for many years, was chief of physical medicine and rehabilitation at the Sunmount VA Hospital.

Dr. Carl J. Mehler of Pittsburgh, a Congress member of long standing, died on September 11, 1954.

National Society for Medical Research Elects Dr. Anton J. Carlson Honorary President at Annual Meeting

Dr. Anton J. Carlson was unanimously elected Honorary President for Life of the National Society for Medical Research at the Society's annual meeting on February 6 in the Palmer House, Chicago. Dr. Carlson had

been president of the NSMR since its inception in 1946.

Spontaneous expressions of appreciation for Dr. Carlson's work on behalf of all research biologists came from several members of the NSMR board, followed by his selection to the new honorary position.

Admiral Boone Retires

The retirement of Vice Admiral Joel T. Boone, (MC), U. S. Navy, Rtd., as Chief Medical Director of the Veterans Administration was announced by Harvey V. Higley, Administrator of Veterans Affairs.

At the same time, Mr. Higley said Dr. William S. Middleton, Dean of the University of Wisconsin Medical School since 1935, would succeed Admiral Boone effective March 1, 1955.

The position of Chief Medical Director in the VA entails responsibility for conduct of the biggest medical program in the United States. The VA presently is operating 172 hospitals which care for nearly a half-million veteran-patients each year; provides daily domiciliary care for nearly 17,000 veterans, and operates 105 clinics serving more than 140,000 veterans each month.

New Training Program Organized

Teachers College, Columbia University, will enlarge its program for training vocational rehabilitation counselors and award a professional diploma in this field for the first time. Dr. Hollis L. Caswell, president of the college, announced.

The college will now be able to train more specialists who can help physically and mentally handicapped persons make the best use of their job potential. The expanded program, made possible by a grant to the college from the United States Office of Vocational Rehabilitation, will be headed by Dr. Abraham Jacobs, former director of vocational rehabilitation at the Longview State Hospital in Cincinnati.

A professional diploma, qualifying a person to be a vocational rehabilitation counselor, will be awarded to students who meet the following requirements: two years of graduate study; one year of satisfactory employment in an approved agency after one year of graduate study, and evidence of satisfactory personal and professional qualifications as judged by the faculty of Teachers College.

Demonstration of the Clinical Management of Poliomyelitis

Baylor University College of Medicine, Southwestern Poliomyelitis Respiratory Center and Jefferson Davis Hospital in cooperation with the National Foundation for Infantile Paralysis, Inc., announce a three day and two evening postgraduate course on the clinical management of poliomyelitis.

The course is designed for physicians, nurses, medical social service workers, physical and occupational therapists to cover complete care of poliomyelitis with emphasis on the severely involved patient, the physician's responsibility in the effective coordination of auxiliary services, and the value of comprehensive care.

DATE: April 19, 20, and 21, 1955.

TUITION: \$8.50 (to accompany application). Syllabus will be furnished.

ACCOMMODATIONS: Arranged by the individual.

APPLICATIONS: William A. Spencer, M.D., Medical Director, Southwestern Poliomyelitis Respiratory Center, Jefferson Davis Hospital, 1801 Buffalo Drive, Houston 3, Texas.

Virology

Academic Press Inc., Publishers, announce a new journal, *Virology*. Recent developments in virology have emphasized the value of the comparative approach. Advances in one area of virus research often have important implications in others.

The purpose of *Virology* will be to publish articles on the biological, biochemical, and biophysical aspects of the subject, stressing contributions of a fundamental rather than applied nature.

It is planned to publish one volume per year. Volume 1, Number 1 is scheduled for release in May 1955. Subscriptions for the

Volume 1, priced at \$9.00, should be sent to the publishers, Academic Press Inc., 125 E. 23rd St., New York 10, N.Y.

APTA to Meet

The 32nd annual conference of the American Physical Therapy Association will be held at the Hotel Jefferson in St. Louis, Mo., June 20-24, 1955. The scientific program will be of a workshop nature, beginning with an introduction to workshop technics. This will be followed by three half-day sessions of ten workshop groups, which will discuss various areas of professional interest as determined by the members.

Reporters and Civilian Observers to Witness Civil Defense Exercises at Nevada Atomic Test

Civil defense exercises and demonstrations at one of the atomic explosions in the 1955 spring test series in Nevada will be witnessed by hundreds of invited civilian observers and reported by the press and other media.

This project, part of the test series announced last September, is the latest in a continuing study of civil effects of nuclear detonations which has been part of the program at the Nevada Test Site since it was put into operation in 1951. The 1955 shot is designed to acquire more civil defense information and experience of the type obtained in the FCDA's "Operation Doorstep" in 1953.

The test series were started in mid-February. The "open shot" for civil defense exercises and demonstrations has been scheduled tentatively for mid-April. Indefinite postponement of the test is possible if weather conditions at the scheduled time are not suitable for the detonation.

Air Force Officer Named to Editorship

According to an announcement by Brigadier General Otis O. Benson Jr., USAF (MC), President of the Aero Medical Association, Colonel Robert J. Benford, USAF (MC) will take over the editorship of that organization's official publication the *Journal of Aviation Medicine*.

Colonel Benford, a native of Omaha, Nebraska, was a member of the staff of the Omaha World Herald prior to attending the University of Nebraska College of Medicine. During World War II, he was air surgeon of the XX Bomber Command, the first B-29 organization to attack the Japanese mainland. Later as commander of the AAF Aero Medical Center in Heidelberg, Germany, he was responsible for collecting all available scientific and historical information concerning wartime achievement of Luftwaffe flight surgeons.

Apparatus Accepted

The following information relative to apparatus accepted by the Council on Physical Medicine and Rehabilitation of The American Medical Association is reprinted, with permission, from the January 1, 1955 issue of The Journal of The American Medical Association.

DeVilbiss Continuous-Flow Nebulizer, No. 840: The DeVilbiss Company, Atomizer Division, P. O. Box 552, Somerset, Pa.

The DeVilbiss Continuous-Flow Nebulizer, No. 840, is designed for the continuous, prolonged delivery of aerosols. The unit consists of a 500 cc. Pyrex jar, a Pyrex glass nebulizer unit, a rubber stopper with one hole to support the nebulizer, and rubber tubing. The weight of this assembly is 500 gm. (1 lb. 2 oz.). The package as shipped measures 15 by 19 by 20 cm. (6 by 7½ by 8 in.) and weighs 770 gm. (1 lb. 11 oz.). The device is intended to nebulize about 500 cc. during a 24 hour period, so that refilling is not often necessary. It is assumed that a constant stream of oxygen or compressed air is supplied at a pressure of 340 to 440 mm. Hg at a rate of 4½ to 8½ liters per minute.

Monaghan Portable Respirator, Universal Model: J. J. Monaghan Co., 500 Alcott St., Denver 4.

The Monaghan Portable Respirator, Universal Model, is an electrically operated apparatus of the cuirass type, which consists of three major parts: the power unit, including motor and pump; the battery unit, for use in case of power failures; and the shell unit, essentially a set of six cuirasses of different sizes.

When the power unit is unpacked, it measures 39.4 by 84 by 26 cm. (15½ by 33 by 10¼ in.) and weighs 23 kg. (51 lb.). The unit operates on either 60 cycle alternating current at 115 volts or direct current at 24 volts and requires 250 to 300 watts input. The battery unit supplies 24 volts.

Raytheon Microtherm, Model CMD-10: Raytheon Manufacturing Company, Power Tube Division, Waltham 54, Mass.

The Raytheon Microtherm, Model CMD-10, is a microwave diathermy generator that operates at a wave length of 12.2 cm. in the 2,400 to 2,500 megacycle band approved for medical use by the Federal Communications Commission and has the commission's type approval D 559. It is identical electronically and therapeutically with Models CMD-4 and CMD-5.

This model further resembles Model CMD-5 in that it is also the console type, mounted on casters. It measures 102 (height) by 63 by 41 cm. (40 by 24¾ by 16¼ in.) and weighs 56.5 kg. (124 lb.). It requires 50 or 60 cycle alternating current at 106 to 126

volts and draws a maximum of 370 watts. Packed for shipment it measures 113 by 70 by 46 cm. (44½ by 27½ by 18 in.) and weighs 70.5 kg. (155 lb.). The shipping weight includes one of each type of director (A, B, and C).

Duke University Inhaler: Ayerst Laboratories, Incorporated, 22 E. 40th St., New York 16.

The Duke University Inhaler is a small device weighing about 450 gm. (16 oz.). It is intended for the administration of trichloroethylene under the supervision of a physician. This liquid (boiling point 87 C.) is poured into a hole at one end of the cylindrical body of the device and is absorbed by the material that lines the wall of the cylinder. A rubber face mask connects with the cylinder. Some obstetric patients can be carried through delivery with analgesia self-administered in this way, but it is understood that the patient must not be left unattended during such self-administration. Packed for shipment the entire apparatus, including the cylindrical inhaler, face mask, and fastening strap, measures 9 by 15 by 14 cm. (3½ by 6 by 5½ in.) and weighs 570 gm. (1¼ lb.).

Medcraft Model D Electroencephalograph: Medcraft Electronic Corporation, 426 Great East Neck Rd., Babylon, N. Y.

The Medcraft Model D Electroencephalograph is an apparatus for making graphic records of the action potentials of the human cerebrum through the intact skull and skin. It is shaped roughly like a writing desk, is mounted on casters for mobility, and houses the entire amplifying and recording apparatus for eight electrode-pairs or channels. The tracings are made by styluses writing with ink on a continuous paper strip. The amplifying system depends on 10 vacuum tubes. The apparatus requires 60 cycle alternating current at 115 volts and draws 85 watts. Unpacked, the apparatus measures 116 (height) by 116 (length) by 60 cm. (45½ by 45½ by 23½ in.) and weighs 227 kg. (500 lb.). Crated for shipment, it measures 122 by 122 by 61 cm. (48 by 48 by 24 in.) and weighs 365 kg. (800 lb.).

Burton Ultraviolet Black Light, Model 1953: Burton Manufacturing Company, 11201 W. Pico Blvd., Los Angeles 64, Calif.

The Burton Ultraviolet Black Light, Model 1953 (Wood's Light), is intended for diagnostic use, such as the examination of the scalp for tinea capitis. It generates a radiation with maximum intensity at about 361 mμ. This lamp requires a source of 60 cycle alternating current at 110 to 120 volts, draws 100 to 125 watts, and is described as a high pressure hot mercury arc lamp.

Dr. Austin Heads New Clinic

Applications are being accepted for admittance to the new Muscular Dystrophy Clinic in Los Angeles, which opened Nov. 10. Patients interested in enrolling for the clinic's specialized services may apply by calling the Muscular Dystrophy Association office at DUnkirk 5-1355 or the Good Hope Clinic, MICHigan 3981 (1241 Shatto St.), where the Muscular Dystrophy Center functions under the supervision of the University of Southern California School of Medicine, with Dr. Elizabeth S. Austin, U. S. C. faculty member and director of physical medicine and rehabilitation at Los Angeles County Hospital, as clinic director. According to Dr. Austin, patients admitted will be given a complete medical examination and social service interview, in keeping with the clinic's aim to render total patient care and family guidance. Orthopedic appliances will be prescribed, physical therapy will be given, and psychiatric assistance will be provided for patient and family.

Newly Registered Therapists

January 4, 1955

Briefer, Maurice B., 56 Glenwood Ave., Jersey City, N.J.

January 17, 1955

Alchier, Alma Jane, 1645 Madison St., Beaumont, Texas.

Beerman, Martha Ann, 825 B. C. Ave., McAllen, Texas.

Caster, Edith C., 3502 Forney Rd., Dallas, Texas.

Feldman, Jerome G., 403 1st Ave. N., Texas City, Texas.

Ferguson, Louis C., 4111 Austin, Houston, Texas.

Lozano, Hector D., 616 Francisco, Mission, Texas.

January 28, 1955

Caruana, Frank James, 186 15th St., Buffalo.

Heuser, Elizabeth McGarock, 114 Third St., Radford, Va.

Kellerman, Francine Veda, 1916 S. Beverly Glen Blvd., Los Angeles.

Welch, Genevieve Florence, St. Ignatius, Mont.

February 2, 1955

Bond, Lola J., 11222 Castalon Dr., Dallas, Texas.

Fixley, Carl Ludwig, 74th and Izard Sts., Omaha, Neb.

Keahey, Patricia, 427 W. Colorado, Dallas, Texas.

Martin, Thomas Edward, 603 E. 30th St., Baltimore, Md.

Smith, Norma Geraldyn, Box 591, Lawton, Okla.

Talley, Nancy Lee, 3504 Junius, Dallas, Texas.

Books Received

Books received are acknowledged in this column as full return for the courtesy of the senders. Reviews will be published in future issues of the journal. Books listed are not available for lending.

Surgical Technigrams by F. M. Al Akl; McGraw-Hill Book Co., Inc., New York City

After the Doctor Leaves by Marguerite Clark; Crown Publishers, New York City

Modern Occupational Medicine edited by A. J. Fleming and C. A. D'Alonzo; Lea & Febiger, Philadelphia

Human Biochemistry (Fourth Edition) by Israel S. Kleiner; The C. V. Mosby Co., St. Louis

The Art of Good Speech by James N. McBurney and Ernest J. Wraga; Prentice Hall, Inc., New York City

Look Better, Feel Better by Bess M. Mensendieck; Harper & Brothers, New York City

Low Back Pain and Sciatica by Louis T. Palumbo; J. B. Lippincott Co., Philadelphia

An Outline of Developmental Physiology by Chr. P. Raven; McGraw-Hill Book Co., Inc., New York City

Workmen's Compensation by Herman M. Somers and Anne R. Somers; John Wiley & Sons, New York City

The American Academy of Orthopaedic Surgeons Instructional Course Lectures, (Volume XI) edited by Program Committee on Instructional Courses; J. W. Edwards, Ann Arbor, Mich.

Biological Effects of External Radiation edited by Henry A. Blair; McGraw-Hill Book Co., Inc., New York City

Pharmacology in Medicine edited by Victor A. Drill; McGraw-Hill Book Co., Inc., New York City

The Physician and His Practice edited by Joseph Garland; Little, Brown & Co., Boston

Coronary Heart Disease in Young Adults: A Multidisciplinary Study by Menard M. Gertler and Paul D. White; Harvard University Press, Cambridge, Mass.

Recent Progress in Hormone Research (Volume X) edited by Gregory Pincus; Academic Press, Inc., New York City

Principles of Internal Medicine (Second Edition) edited by T. R. Harrison, et al; The Blakiston Co., New York City

Human Physiology by W. B. Youmans; The MacMillan Co., New York City

Textbook of Medicine (Eleventh Edition) by Mann & Conybeare; The Williams & Wilkins Co., Baltimore

Time Distortion in Hypnosis by Cooper &

Erickson; The Williams & Wilkins Co., Baltimore

Heart—A Physiologic and Clinical Study of Cardio-Vascular Diseases (Second Edition) by Aldo A. Luisada; The Williams & Wilkins Co., Baltimore

The Digital Circulation by Milton Mendlowitz; Grune & Stratton, Inc., New York City

Treatment of Acute Poliomyelitis (Second Edition) by William A. Spencer; Charles C. Thomas, Publisher, Springfield, Ill.

Handbook of Medical Treatment (Fourth Edition) edited by Milton Chatton, et al; Lange Medical Publications, Los Altos, Calif.

Clinical Aspects of the Autonomic Nervous System by L. A. Gillilan; Little, Brown & Co., Boston

Legal Medicine edited by R.B.H. Gradwohl; The C. V. Mosby Co., St. Louis

Human Limbs and Their Substitutes by Paul E. Klopsteg and Philip D. Wilson; McGraw-Hill Book Co., Inc., New York City

Die Wirbelsäulen-Verletzungen Und Ihre Ausheilung by Alfons Lob; Georg Thieme Verlag, Stuttgart, Germany

The Neuroanatomical Basis for Clinical Neurology by Talmage L. Peele, McGraw-Hill Book Co., Inc., New York City

The Role of the Pituitary in Cancer by Henry K. Wachtel; The William-Frederick Press, New York City

The Adolescent Exceptional Child, a Realistic Approach to Treatment and Training by The Woods Schools; Child Research Clinic, Langhorne, Pa.

Diagnosis and Treatment of the Acute Phase of Poliomyelitis and Its Complications edited by Albert G. Bower; The Williams & Wilkins Co., Baltimore

An Outline of Neurology by Ian A. Brown; Wm. C. Brown Co., Dubuque, Iowa

Diagnosis of Soft Tissue Lesions by James Cyriax; Paul B. Hoeber, Inc., New York City

An Introduction to Physics in Nursing (Second Edition) by Hessel Howard Flitter; The C. V. Mosby Co., St. Louis

The Clinical Use of Corticotropin, Cortisone and Hydrocortisone in Eye Disease by Dan M. Gordon; Charles C. Thomas, Publisher, Springfield, Ill.

Vitamins and Hormones (Volume XII) edited by Robert S. Harris, et al; Academic Press, Inc., New York City

Human Physiology (Second Edition) by Bernardo A. Houssay, et al; McGraw-Hill Book Co., Inc., New York City

Anatomy: Regional and Applied by R. J. Last; Little, Brown & Co., Boston

Geriatric Nursing (Second Edition) by Kathleen Newton; The C. V. Mosby Co., St. Louis

An Outline of Psychiatry by Clarence J. Rowe; Wm. C. Brown Co., Dubuque, Iowa

Healthier Living by Justus J. Schifferes;

John Wiley & Sons, Inc., New York City

An Introduction to Pathology (Second Edition) by G. Payling Wright; Longmans, Green & Co., Inc., New York City

Dr. Hines Honored

Dr. Thomas F. Hines, director of physical medicine and rehabilitation at the Grace-New Haven Community Hospital and assistant professor of medicine, Yale University School of Medicine, has been cited for outstanding service by the President's committee for employment of the physically handicapped. Dr. Hines directed the establishment of the poliomyelitis clinic at the above hospital in 1952, and in 1953 a clinic for rehabilitation of the physically handicapped was established that uses the services of 14 physical therapists and includes a 31 bed ward and equipment necessary for special patient care. Since the program has been started, the hospital has received a grant of \$20,500 for increasing physical therapy services from the National Foundation for Infantile Paralysis. Another grant by the foundation has provided \$150,000 for rehabilitation teaching at Yale.

Linck Resigns As NSCCA Director

Lawrence J. Linck, who has served as executive director of the National Society for Crippled Children and Adults since 1945, has resigned his position, according to a January 10 announcement made by Edgar Kobak, President. No effective date has been set.

Mr. Linck will remain at his present post in Chicago until the appointment of a new director. Mr. Kobak, speaking for the board of trustees, expressed the hope that Mr. Linck would continue to serve the society in a voluntary role as secretary and as consultant to the Board of Trustees. Mr. Linck as yet has not announced his future plans.

Under Mr. Linck's direction, during the past ten years, the Crippled Children's organization has become the largest voluntary organization in the world serving the handicapped. Since 1945 the organization has been expanded to a total of 52 such units including all 48 states, District of Columbia, Alaska, Hawaii and Puerto Rico.

A member of the Board of Directors and Executive Committee of the National Health Council and the United States representative on the Council of the International Society, Mr. Linck's achievements have brought wide recognition from medical leaders, educators and distinguished persons.

Physicians Wanted for Service in Japan

The Atomic Bomb Casualty Commission of the National Academy of Sciences, which is conducting a long-term medical follow-up

study of bomb survivors for late or delayed effects of radiation, is seeking an internist and a pathologist to serve as department heads at the Nagasaki installation in Japan. By July it is anticipated that replacements may be needed for two internists, one or two pediatricians, two head nurses, a radiologist, and supervisors for x-ray and clinical laboratories. The commission maintains modern clinics in both Hiroshima and Nagasaki. Medical personnel, recruited for two-year terms of service, participate in the over-all routine research program and are encouraged to undertake individual problems as well, the scope of the research opportunity being largely limited by the ingenuity and research drive of the individual investigator. The commission pays for the transportation of staff members, their families, household goods, and car to and from Japan and provides houses with basic furniture, rugs, dishes, kitchen utensils, electric stoves, and refrigerators at nominal rentals. Elementary and high schools of the local U. S. Army post are open to children of ABCC families. Salaries are about the same as for comparable positions in the United States. The cost of living, however, is somewhat lower in Japan, and income taxes are refundable after 18 months in Japan. Information may be obtained from Frank H. Connell, Ph.D., Executive Director, Committee on Atomic Casualties, Division of Medical Sciences, National Academy of Sciences—National Research Council, 2101 Constitution Ave., Washington 25, D. C.

Ultrasonic Therapy Apparatus and The Federal Communications Commission

Ultrasonic apparatus being provided for therapeutic purposes in the United States today usually contains as one of its component parts a generator of oscillating currents of either 800 or 1,000 kilocycles per second. These currents in turn are impressed upon a piezo-electric crystal that generates the ultrasonic waves. The electromagnetic energy generated by these oscillators can well become a potential hazard by interfering with standard radio broadcast bands and other forms of radio communication. Accordingly, such equipment comes within the purview of the Federal Communications Commission. In order to minimize the probability of interference, the rules covering such equipment require, among other things, that radiation of radio frequency energy and the radio frequency voltage fed back into the power supply lines be limited and that the equipment be recertified every three years as to its compliance with these requirements. In view of the growing use of ultrasonic equipment, the FCC, in May, 1954, issued a Notice of Proposed Rule Making, which would establish

more detailed technical requirements and provide a type approval system for ultrasonic therapy apparatus similar to that used for short-wave diathermy equipment.

At the present time, ultrasonic generators used by the medical profession have been employed primarily in laboratory and clinical investigations to determine the safety and efficacy of ultrasonic therapy; however, it is anticipated that they will be used in medicine more generally in the not too distant future. The Council favors the establishment of a type approval system for such devices by the Federal Communications Commission before a great number of physicians acquire these devices. Establishment of such a system will preclude the necessity of periodic recertification of these instruments. In the meantime, the general medical profession is urged to be certain before acquiring ultrasonic therapy apparatus that adequate filtering of the power supply line and shielding of the device have been provided and that the equipment is properly certificated as to compliance with the present rules, or to wait until FCC type-approved apparatus is available.

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THE NATL. SOCIETY FOR CRIPPLED
CHILDREN AND ADULTS, INC. 11 S.
LASALLE STREET, CHICAGO 3, ILL.

PHYSICAL MEDICINE ABSTRACTS

Experiments on Pain Referred from Deep Somatic Tissues. B. Feinstein, et al. *J. Bone & Joint Surg.* 36A:981 (Oct.) 1954.

In this article the referred pain resulting from stimulation of deep pain endings in the paravertebral muscles of the neck and back, from the first cervical to the third sacral level, has been mapped for a number of normal subjects. Stimulation was obtained by injecting 0.5 to 1.0 ml. of six per cent saline into the muscles just lateral to the interspinous ligament. Position of the injection was determined by taping a small lead pellet over the site of injection and checking with x-ray. The pain produced lasted but a few minutes. It was deep and aching in type, although hard to define and rather difficult to localize specifically. The authors have mapped the observed locations of referred pain in response to these stimuli throughout the length of the spine. This study will prove to be of clinical interest in helping to explain the site of origin of referred pain due to injury or disease of the spine or its ligaments.

Use of a Recording Dynamometer in Clinical Medicine. W. R. Russell. *Brit. M. J.* 2:731 (Sept. 25) 1954.

There are many occasions in clinical medicine when the study of muscle strength and function is important. Disorder of the motor functions may be reflected in different ways; many are amenable to some system of recording.

This article describes a simple recording dynamometer; gives numerous illustrations of examples of records taken by the machine and furnishes a brief but adequate discourse of a number of medical conditions in which the machine may furnish information of diagnostic significance.

The recording dynamometer was designed by Dr. E. H. J. Schuster and is manufactured by H. G. East & Co., Longworth Rd., Oxford, England. Fundamentally it is an electronic apparatus with two inkwriters and two handgrips, side by side. Two or more strengths of spring are available and the maximum grip which can be recorded is 90 pounds (41 kg.). The recording paper is moved by precision clock work. Two speeds are available. Both hands may be tested to-

gether or each hand separately. The entire apparatus is small and can be conveniently used in the physician's office.

Its use has proved very informative in the following conditions: Disease of muscle; focal cerebral lesions; disorders of motor function; hysteria and malingering and, rheumatic conditions.

The Use of Antibiotics for the Prevention of Rheumatic Fever. G. H. Stollerman. *Am. J. Med.* 17:757 (Dec.) 1954.

Much can be done to prevent rheumatic fever. The group A streptococci have been firmly established as the inciting agent in the first and recurrent attacks of the disease. The intelligent and judicious employment of chemotherapeutic agents should make the prophylaxis of rheumatic fever feasible and practical. It is not known yet whether continuous prophylaxis maintained for several years will diminish the rate of attack of rheumatic fever following streptococcal infection.

The selection of patients for continuous chemoprophylaxis logically should be made on the basis of a recent well-defined attack of rheumatic fever. This selection cannot be made solely on the basis of age, severity of the attack, or limitation of the overt disease process to the joints or central nervous system.

If sulfa drugs are used as the prophylaxis, sulfadiazine is recommended in daily doses of 1.0 gm. given either as a single dose or in divided doses. When penicillin is used, single doses of 50,000 to 100,000 units daily, given orally, are effective in preventing streptococcal infections.

Cerebral Palsy and Brain Damage in Pediatric Practice. R. E. Bruner. *J. Iowa M. Soc.* XLIV(12):558 (Dec.) 1954.

A fair working definition of cerebral palsy is a faulty development of, or damage to, the brain resulting in difficulty of muscular control. Furthermore, it is important to realize that about fifty per cent of these patients have additional symptoms of brain damage which require treatment if they are to obtain maximum benefit. Examples of these additional symptoms are blindness, deafness, con-

vulsive disorders, disturbed behavior, mental retardation, and loss of perception. These may occur in varying ways and be so minor that they are difficult to detect.

What can be done for a child who is less than one year of age? He should, as far as practicable, have the same experiences as he would normally have had at any given age. It must be remembered that these children improve only with practice. In the effort to remove retarding factors, control of seizures as soon as possible is important. Elimination of constipation and early establishment of good disciplinary habits have great value. The parents should be informed of probable brain damage, but care should be taken not to foretell the future.

A child with cerebral palsy can be benefited by use of physical therapy as early as six months of age. A program of postural activities for the child which will prevent deformities should be shown to the family. Certain deformities are more easily prevented than corrected later.

Effect of Thyroidectomy in Rheumatoid Arthritis. Veikko A. I. Laine, et al. *Ann. Rheumat. Dis.* 13(3):250 (Sept.) 1954.

There are numerous reports on the relationship between painful joints and function of thyroid gland. The generally accepted opinion is that malfunction of the thyroid is of no etiologic significance in rheumatoid arthritis. To determine the relationship between rheumatoid arthritis and malfunction of the thyroid, a series of twenty-eight rheumatoid arthritic patients who had had thyroidectomies either while suffering from rheumatoid arthritis or immediately before its onset was compared with ninety-seven patients with rheumatoid arthritis who had had major surgery not related to the endocrine system and exclusive of removal of possible foci.

This series indicated that strumectomies frequently resulted in a marked aggravation of rheumatoid arthritis. Since no such tendency could be noted in the controls, this aggravation must be considered a specific sequel, the effect of which is mostly manifested in the sphere of the endocrinal balance.

It was obvious in some of the cases that there had been a failure to discriminate between prodromal symptoms of rheumatoid arthritis and symptoms of thyrotoxicosis. It is desirable to stress that, under certain conditions, confusion of these two diseases can easily occur.

Disappearing Bones: A Rare Form of Massive Osteolysis. L. W. Gorham, et al. *Am. J. Med.* 17:674 (Nov.) 1954.

The gradual and often complete resorption of a bone or group of bones is an unusual phenomenon. Disuse atrophy of bone is a well-recognized phenomenon, but generally

the reduction in size of the affected bone is not great and takes a long time to develop. Sudek's atrophy progresses rather rapidly, and the atrophied bone remains and may function to some degree. Osteolysis, to a considerable extent, has been observed in rheumatoid arthritis, leprosy, *malum perforans* and congenital pseudarthrosis. The authors report two cases and discuss sixteen other cases in which bone atrophy progressed to complete disappearance of the affected bone, leaving little but bands of fibrous tissue.

This unusual disease occurs generally in children or young adults — equally in males and females. Trauma, usually slight, is a common though probably only an incidental initial complaint. Angiomatosis, usually hemangiomatosis, has been found in the affected bones or in the adjacent soft tissues in a significant number of cases. These are possible etiologic factors since these conditions cause disturbances in the balance of osteoblast-osteoclast activity. Diffuse inflammation of soft tissues involving peripheral nerves may play an indirect role in causing bone atrophy.

This unusual disease of bone progresses slowly and may cease to advance after a period of years. One case reported terminated fatally.

The Adult Cerebral Palsied in Need of Custodial Care. Mary E. Callahan. *Brit. J. Phys. Med.* 17(12):270 (Dec.) 1954.

The author asks the following questions: What happens to the handicapped individual when his parents are gone? Are there provisions for livelihood for the adult with little or no mental impairment but whose educational achievements and vocational potential may be limited only by severe physical disability? It is her belief that, if every effort is made to remedy the findings of the more recent surveys of crippled children's programs in various areas, eventually the cerebral palsied will be more productive citizens and there will be less need for custodial care in later life. These studies emphasize the need for early detection, early training, early guidance, and realistic education for the cerebral palsied. They reveal that the degree of involvement is not the controlling factor in the placement of the cerebral palsied. The important factor for successful placement is early training of the child by the parents so that the child can fend for himself to the greatest possible degree.

Existing institutions, such as the nursing homes and hospitals for the chronically ill, must be developed and communities must have an interest in organizations which assist these people. It is suggested that insurance companies could arrange for parents to set up some income plan for patients at a certain age.

The guidance program which has been carefully planned by all concerned with the

patient and his family, can be most effective. However, it will be successful only when the parents are relieved of the fear and insecurity of not knowing what will become of the patient when his home and family are gone.

The Use of Pathological and Unlocking Reflexes in Rehabilitation of Spastics. Temple Fay. *Am. J. Phys. Med.* 33:347 (Dec.) 1954.

A number of the well established physiological reflexes in relation to body position and motor patterns for progression by crawling is considered. It is pointed out that many of these reflexes appear purposeful for progression only if the animal is lying prone, whereas, clinically they have usually been elicited while the patient was supine and consequently they appear to be relatively useless. Emphasis is made on the fact that proper utilization of these reflexes may make possible activity which is otherwise impeded by neurological diseases. The author suggests that utilization of the stretch reflexes in spasticity may be useful therapeutic exercise to maintain strength and also diminish the spasticity. Utilization of the tonic neck reflex while the patient is prone in water or deep sand produces an amphibian type crawling motion useful to initiate the crawling pattern. Spasticity of the flexors of the fingers can be released and active extension often obtained when the patient is lying prone with the face toward the opposite shoulder and the back of the hand resting on the ipsilateral buttock. The utilization of other reflexes to release or activate the arm and lower extremity are also described. Clearly described in this paper is

the performance of the reflexes which the author has advocated for a number of years as a means of therapeutic exercise in treatment of upper motor neuron disease.

A Study of Lower Extremity Amputation in Geriatric Rehabilitation. G. Gingras, et al. *Brit. J. Phys. Med.* 17(12):265 (Dec.) 1954.

Many patients mistakenly believe that a prosthesis will eliminate all their physical and financial difficulties. Not infrequently essential rehabilitation procedures will be forgotten in a frantic effort to secure a prosthetic appliance in spite of sound medical advice to the contrary. It was believed that many patients were not using a prescribed prosthesis after receiving it. For these reasons the authors reviewed ninety patients, fifty or more years of age, who had had amputations of the lower extremities. They also had been registered with the Rehabilitation Institute of Montreal since 1950.

The authors conclude that: All geriatric patients referred for fitting of prosthetics of lower extremity, particularly if they are diabetic or have peripheral vascular disease, should undergo a complete physical, psychological (psychiatric, when required), social and vocational screening; prostheses are far from being the answer to the rehabilitation of the aged; as a result of maximal rehabilitative procedures, a large percentage of cases can live at home, in lieu of being hospitalized in institutions, and lower extremity amputees can be gainfully employed, whether they use a limb or wheelchair.

EASTERN SECTION TO MEET —

The Eastern Section of the American Congress of Physical Medicine and Rehabilitation will meet Saturday, April 23, 1955 at Hotel Lenox, Boston. Speakers for the morning session include Doctors Hans Behrend; A.B.C. Knudson; Harold Lefkoe; Albert A. Martucci, and Jack Meislin. Three discussion panels and their participants are: HANDS — Doctors Charles Bradford; J. Edward Flynn; Henry C. Marble, and Herman Rudolph; BACKS — Doctors Alexander Aitken; John C. Nemiah; Wm. Benham Show, and Arthur L. Watkins; GENERAL PRACTICE — Doctors Heinrich G. Brugsch; Madge C. L. McGuinness; William H. Schmidt, and Mr. Stanwood L. Hanson. Complete details covering the meeting may be had by writing Jacob L. Rudd, M.D., Secretary, 371 Commonwealth Ave., Boston.

BOOK REVIEWS

The reviews here published have been prepared by competent authorities and do not necessarily represent the opinions of the American Congress of Physical Medicine and Rehabilitation and/or the American Society of Physical Medicine and Rehabilitation.

MEDIZINISCHE POLIKLINIK: VORLESUNGEN UBER INNERE MEDIZIN. By Dr. Erwin Schliephake, Professor in Giessen. Second edition. Cloth. Price, 32 marks. Pp. 704, with 202 illustrations. Gustav Fischer, Villengang 2, Jena 15b, Germany, 1953.

Few literary contributions of foreign extraction have aroused so many sided positive comments as has this voluminous text. It is ingeniously paced and directed to the practical need for bedside and clinical teaching based on objective demonstration. Its encyclopedic content is presented in that informal style associated with polyclinical lectures, and its reading has that extra-attractive quality of immediacy and tangibility experienced when in contact with clinical material in hospital or academic environment. In more than 700 pages, Prof. Schliephake has presented in vivid but terse exposition, his twenty-five years of clinical lectures to succeeding medical students. The vividness of his exposition had the virtue of reducing the tedium of formal reading to its minimal necessity while exciting memory to its greatest retention. The impression, therefore, is that Schliephake's experience is so close to his retentive memory as to be able to transfer this feeling and enthusiasm to the collective ear of his many students. The first edition was exhausted within seven months because demands from postgraduate colleagues and general practitioners felt the need of his summarized but exhaustive exposition covering the entire terrain of internal medicine in printed form.

The present and second edition has been materially revised in an upward direction, and benefited by the inclusion of a timely review of the new advances in endocrinology and its clinical validity from both a diagnostic and therapeutic viewpoint. Therein it is apparent the author expresses opinions fresh from personal laboratory and bedside studies. Also scattered throughout this volume are some highly interesting observations of an original nature pertaining to the value of shortwave irradiation (*durchfütung*) as a provocative diagnostic agent as well as of its therapeutic

benefit. Discussing its diagnostic use Schliephake points out that its provocative local action in empyema of the gallbladder will after five minutes of irradiation produce a rise of leukocytic count invariably significant of the presence of pus. In contrast, suspicious swellings (tumors) so irradiated in the absence of suppuration, a rise of leukocyte count will always indicate the presence of deep seated pus and its absence or fall, the presence of a non-suppurating process, similar to its action on Tbc. (p. 386; see also p. 394 for provocative S.W. diagnosis between acute and chronic appendicitis, pp. 461 and 546 for myocardial provocative diagnosis).

The foregoing observations together with many other discussions pertaining to the value of short wave therapy (pp. 95, 122, 444, and 585) as well as other constructive observations related to the valuable integration of physical and pharmaco-biochemical medicine, demonstrate an authoritative experience seldom encountered in a text of this dimension and subject. This can readily be appreciated because Schliephake is regarded as the outstanding pioneer in short wave practice, and stamp his original labors in both fields as the voice of authority. This opus is therefore a timely contribution that would serve best the world of Anglo-American readers by its translation at the earliest date. The approach of its exposition is original in style, informative in content and highly interesting to all who seek the clinician's approach to the vast terrain of internal medicine.

LOW BACK PAIN AND SCIATICA. By Louis T. Palumbo, M.D. Cloth. Price, \$3.00. Pp. 104, with 35 illustrations. J. B. Lippincott Company, 227-231 S. Sixth St., Philadelphia 5; Aldine House, 10-13 Bedford St., London, W.C.2; 2083 Guy St., Montreal, 1954.

It is gratifying to find a review monograph such as this available in book form at low cost. There is need for such information on the more common and controversial subjects for the guidance of the general practitioner. Dr. Palumbo has wisely refrained from detail,

particularly in the field of surgical care since this is readily available in the original articles. Instead, he has concentrated on trying to place the low backache on a common and understandable ground, to permit an orderly, advancing, planned, positive approach to specific diagnosis, and treatment.

The monograph is well organized, easy to read, and readily understood. It is brief but always succinct, and is thoroughly worthwhile.

PNEUMONIA. By *Hobart A. Reimann*, M.D. Cloth. Price, \$5.75. Pp. 236, with 17 illustrations. Charles C Thomas, Publisher, 301-327 E. Lawrence Ave., Springfield, Ill.; 1954.

This is one of the monographs in the Bannerstone Division of American Lectures in Chest Diseases. It is a compendium of many kinds of pneumonia, but with most attention given to those which are of greatest interest to the physician. The author has contributed to the knowledge of pneumonia beginning in the days of serotherapy. The conventional plan of presentation is followed for each kind of pneumonia, and a most interesting and complete classification is presented. This excellent work is a worthwhile reminder that we still have the problem of pneumonias and of varied etiology, even though the revolutionary therapy of recent years has markedly reduced the mortality rate.

ON APHASIA: A CRITICAL STUDY. By *Dr. Sigmund Freud*. Cloth. Price, \$3.00. Pp. 105. International Universities Press, Inc., 227 W. 13th St., New York 11, 1953.

First published in 1891 in German, this is one of Freud's earlier works on a subject which he apparently did not follow up. An analysis is presented of the then current theories of aphasia which attempted to explain all types of anatomical localization of a lesion in the brain. Freud feels this is not a practical approach and stresses the functional aspects of the speech apparatus. He classifies aphasia as verbal, asymbolic, and agnostic, with the last classification being a purely functional disorder. Although interesting to students of Freud, the book is probably of more historical than clinical value.

PHYSICAL THERAPY AFTER AMPUTATION. THE TREATMENT OF THE UNILATERAL LOWER-EXTREMITY AMPUTEE. By *Margaret Bryce*. Paper. Price, \$1.50. Pp. 93, with illustrations. The University of Wisconsin Press, 811 State St., Madison, 1954.

This book is an adequate guide for the physical management of a unilateral, lower extremity amputee, from the day after surgery to ambulation with a prosthesis. Included

are chapters on bed positioning, exercises, prosthetic training, limbs, prostheses, and suction socket, which are all illustrated diagrammatically.

This publication will be helpful to physical and corrective therapists, as well as physiatrists, and other physicians dealing with amputees.

ULTRASONIC AND ULTRASHORT WAVES IN MEDICINE. By *Johanna M. Van Went*, M.R. Cloth. Price, \$9.00. Pp. 384, with 33 illustrations. Elsevier Press, Inc., 402 Lovett Blvd., Houston 6; 155 E. 82nd St., New York 28, 1954.

Between somewhat philosophical historical introductions to the book as a whole as well as to the sections on ultrasonic and ultrashort waves and a quaint closing epilogue, the author, who is director of the institute for physical medicine and rheumatism in Amsterdam, has crowded a considerable amount of information on the character and application of these physical agents and on the therapeutic results obtained. The part on ultrasonics is the smaller one of the two, covering about 128 pages. After a short description of the production of ultrasonic waves, their properties and use, there follows a discussion of biological effects on bacteria, various organs of animals, tissues, blood and finally human beings. A number of harmful effects of ultrasonic waves as reported in the literature are described. They are edemas, destructive action on peripheral nerves and the lower part of the spinal cord, disturbance of equilibrium, anginal symptoms, tachycardia and petechial hemorrhages. The author states she has never observed such effects and believes that apparently the intensities used in these cases was of the order of five watts per square centimeter, which would seem too high. For ordinary therapeutic dosages of the order of less than three watts per square centimeter, the action of ultrasonic waves is largely a thermal one, although the author definitely believes that other effects also play a role. General indications for ultrasonic treatments are enumerated in diseases of the spine, the joints, chest abdomen, ear, skin and many others. Contra-indicated are treatments in cardiac diseases, vascular affections, tumors and other diseases.

Two short chapters conclude this section on ultrasonic waves. They deal with the diagnostic use of ultrasonic waves for the detection of cerebral processes and present a list of additional applications of ultrasonics, for example their use in guiding blind persons, air-purification, preservation of emulsions, degassing of fluids, etc. The entire discussion of the use of ultrasonic waves as presented in this book reveals that there still exists a considerable diversity of opinion regarding the use and value of ultrasonic waves in the treatment of various diseases. This is also appar-

ent when studying the vast bibliography of approximately 1200 publications on the subject which appears in the appendix of the book. The conservative but yet investigative approach of the author to the subject as a whole as well as its presentation in this book will help bring forth a better understanding of and agreement on the various phases of ultrasonic treatments.

The much larger second part of the book on ultrashort waves presents less controversial material because diathermy therapy is much older and more experience with it has been gained. The author prefers the term "ultra short wave treatment" because the expression "diathermy" draws attention mainly to the thermal effect produced. She believes, just as in the case of supersonic waves, it is not heat alone which produces the total therapeutic answer. Short-wave therapy (wavelengths ten to thirty meters), ultra-short-wave therapy (wavelengths one to ten meters) and micro-wave therapy (wavelengths less than one meter) are then discussed although the author had not had personal experience with the last named modality. Discussion of the material follows the same pattern as that in the ultrasonic section. A chapter on hyperthermia with indications and contra-indications concludes the book. An extensive bibliography of approximately 1000 titles is appended to the second part of the text. The book was printed in Holland. Type and illustrations are excellent. It can be recommended to every one who is interested in the practical use of ultrasonic and ultrashort waves.

HEART: A PHYSIOLOGIC AND CLINICAL STUDY OF CARDIO-VASCULAR DISEASES. By *Aldo A. Luisada*, M.D. Second edition. Cloth. Price, \$15.00. Pp. 680, with 313 illustrations. Williams & Wilkins Company, Mount Royal and Guilford Aves., Baltimore 2, 1954.

Dr. Luisada is a cardiologist who has distinguished himself in various aspects of research connected with heart disease. The second edition of his textbook has recently been published eight years after the appearance of the first book.

During the period between these editions there have been numerous advances as well as changes in theory and practice in all of medicine. This applies particularly to diseases of the heart.

Many chapters in this text have been completely rewritten. New material has been added under the headings of Cardiovascular Syphilis, Prognosis of Cardiovascular Diseases, and The Social and Legal Aspects of Heart Disease.

The book is packed with interesting and valuable information that will appeal to every physician who is concerned with the care of the individual patient. As an example, in the chapter on Rheumatic Disease, a relationship

between rheumatoid arthritis and lesions of the heart is discussed. There are numerous, and carefully selected illustrations.

This is a splendid textbook on the subject of heart disease. It maintains the high standard of excellence that the author has established by his previous contributions.

HUMAN LIMBS AND THEIR SUBSTITUTES. By *Paul E. Klopsteg*, Ph.D.; *Philip D. Wilson*, M.D., et al. Cloth. Price, \$12.00. Pp. 844, with 254 illustrations. McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, 1954.

This book is outstanding as a literary work in the field of prosthetics today. Certainly, it is the most complete, having been produced by the combined efforts of thirty experts who represent many disciplines.

It has long been said that proper fitting of a prosthesis for an amputee demands skilled teamwork. Here at last is a book by the various team members — physicians, engineers, physiologists, psychologists, therapists, prosthetists, chemists and manufacturers.

Anyone who is working with amputees or prosthetics will want this book available as a reference source to help with the many difficult problems encountered in this field.

THREE MEN: AN EXPERIMENT IN THE BIOGRAPHY OF EMOTIONS. By *Jean Evans*. Cloth. Price, \$3.75. Pp. 297. Alfred A. Knopf, Inc., 501 Madison Ave., New York 22, 1954.

The author, Canadian born, wrote and published poetry while she was still in her teens. At nineteen she joined the staff of a Southern California weekly and two years later she came to New York. After working for several years as a researcher for the Living Newspaper, a production of the Federal Theater Project, she became a feature writer for PM, a former New York newspaper which welcomed experimental feature writing. Here the author began writing her remarkable "portrait interviews" from which eventually the present book grew. Some of these portraits appeared also in the Journal of Abnormal and Social Psychology and attracted the attention of professional psychologists. The author received several honors for her work. Among these was a Guggenheim Fellowship on which the present book "Three Men" was written. In it, she introduces with great skill, three strange and tortured characters — Johnny Rocco, leading a life of crime; William Miller, a blind and lonely fantasist, and Martin Beardson, a weird homosexual. These lives are presented directly, simply and with great impact, in a remarkably straightforward literary style. These three men are not "cases" but talking and living human beings. The reason for this lies primarily in the approach of the

reporter-author to the study of her subjects. She interviewed the men themselves but also talked to all available people around these men in their homes or in institutions. She talked about them to respective experts in medicine, sociology and psychology. She studied the social-work records, medical records and other documents when they were available. Then she attempted to present these men as they presented themselves to her with the result that three most remarkable biographies come to life. Since these are not fictional stories and since they go on and on, each individual biography is supplemented by a "follow-up" and an "afterword" with the latest life data of the three men concludes the book. Everybody and notably students of psychology will read this book with a great deal of interest.

CANCER: DIAGNOSIS, TREATMENT, AND PROGNOSIS. By *Lauren V. Ackerman, M.D.* and *Juan A. del Regato, M.D.* Second edition. Cloth. Price, \$22.50. Pp. 1201, with 725 illustrations. C. V. Mosby Company, 3207 Washington Blvd., St. Louis 3, 1954.

The second edition of the text has utilized the same satisfactory format as the first edition. By virtue of extensive revision, additions, and new illustrations, the value of the contents of the book has been markedly amplified.

It is the stated intent of the authors to present in a correlated, composite form the various aspects of oncology. The clinical features and the evolution of the diagnostic picture are integrated with the basic pathology. This is well done with good basic reference material indicated. Avoiding detailed surgical and radiotherapeutic discussion, the authors do indicate in general terms the therapy which they consider best. Students of special aspects of malignancies will find inadequate detail on points of particular interest. The remainder of the medical profession, however, will welcome the text as a highly valuable, fundamentally sound clinical reference and guide. It is to be highly recommended.

PRINCIPLES OF OCCUPATIONAL THERAPY. Edited by *Helen S. Willard, B.A., O.T.R.* and *Clare S. Spackman, B.S., M.S., O.T.R.* Second edition. Cloth. Price, \$5.50. Pp. 376, with 61 illustrations. J. B. Lippincott Company, 227-231 S. Sixth St., Philadelphia 5; Aldine House, 10-13 Bedford St., London, W.C. 2, England; 2083 Guy St., Montreal, Canada, 1954.

As the title implies, this is a work dealing with *principles*, particularly those concerned with the technics and methodology of Occupational Therapy. For students of occupational and physical therapy and for practicing physicians who need an introduction to such

principles, it will serve an extremely useful purpose. As a source book on the history of the development of Occupational Therapy it also performs a valuable service. There are excellent reference lists provided in each section for those who wish to acquire more extensive information relative to the various arbitrary categories into which the editors divide the subject matter of Occupational Therapy.

In the Preface to the Second Edition the editors state, "It is hoped that this second edition will be even more useful in setting forth the nature of Occupational Therapy to those interested in gaining an understanding of it and in providing a means of presenting the basic principles and theories of the profession to students of both occupational therapy and physical therapy." In this they have quite capably succeeded. It is unfortunate that they did not utilize the opportunity presented to them to develop more tangibly the concept of the role of Occupational Therapy in the overall rehabilitation program. The increasing importance of occupational therapy in the fields of prevocational exploration and training, in the teaching of efficient work habits, and in the building of increased work tolerance for the rehabilitee are mentioned only by implication. Despite these deficiencies this book will prove an asset to those who use or teach occupational therapy both as a reference source and as a formal outline of principles.

AMERICAN ACADEMY OF ORTHOPAEDIC SURGEONS INSTRUCTIONAL COURSE LECTURES. VOLUME XI. Edited by Program Committee on Instructional Courses, *R. Beverly Raney, M.D.*, Chairman, et al. Index Volumes I-X, 1943-1953. Cloth. Price, \$12.00. Pp. 365, with illustrations. J. W. Edwards, 1745 S. State St., Ann Arbor, Mich., 1954.

The "Instructional Course Lectures" have become as familiar to orthopedic and traumatic surgeons as the "Journal of Bone and Joint Surgery," having been published yearly since 1943, with the single exception of 1945. This latest volume is of equal stature, and has the added advantage of an index to the first ten volumes.

The increasing trend toward symposia is good, based on the thesis that a few topics covered well are better than many which are touched upon briefly. Notable in this issue is the discussion on soft-tissue tumors of the extremities; the unit on the intervertebral disc; the section on genitourinary injuries associated with pelvic fractures, and a unit on various aspects of fracture care.

Frederic Bost has two of his deservedly famous "Surgical Approach" series — to the hip and to the knee. These articles and the well-known Veterans Administration films are classics which are constantly being used by all practicing musculoskeletal surgery.

Aufranc's course on mold arthroplasty and Carr's on missile wounds of the extremities (derived from the Korean War) have the weight of extensive experience.

In addition are courses ranging from poliomyelitis, pediatric roentgenology and nerve and arterial injuries to anesthesia and fluid balance.

It should be emphasized that, not only this volume, but the entire series is essential to the library of anyone practicing orthopedic or traumatic surgery.

PHARMACOLOGY IN MEDICINE. A COLLABORATIVE TEXTBOOK. Edited by Victor A. Drill, M.D., Ph.D. Cloth. Price, \$19.50. McGraw-Hill Book Company, Inc., 330 W. 42nd St., New York 36, 1954.

The size of this book is an indication of the tremendous continuing progress in the field of pharmacology. It is a survey of current pharmacological information in a single volume. Not only its timeliness, but more important, the weight of more than eighty authorities who have collaborated in its preparation, makes this an important contribution to the medical literature. One is tempted to say that this marks an important milestone. Dr. Drill has carried out a notable accomplishment in welding this diversity of authorship into an excellent and coherent review of the field. It is indeed well written, authoritative, up to date, and comprehensive.

This work receives the whole-hearted support and recommendation of the reviewer. It should be in the library of all physicians, and would find regular and frequent use as an aid in therapeutic problems. It is especially recommended to students, whether in clinical or pre-clinical training.

Two possibly unfavorable points arise in the evaluation of this book for the use of medical students in the first course in pharmacology. Is the student likely to be overwhelmed by the encyclopedic nature of this text? Is not the cost, \$19.50, almost prohibitive? The matter of expense should not enter into such a decision in any primary way. If the textbook is outstanding from the teaching standpoint, it surely must be used. The problem of whether there is too much material for satisfactory student use will only be decided through future use. To the physician who must make daily evaluations and decisions concerning current pharmacological practice, this book is recommended without reservation. It should be one of the key volumes in his basic library.

The eighty-seven separate sections are so well integrated, even though written by eighty-two contributors, that there is no feeling of an absence of continuity. The style is simple and very understandable. The subject matter and arrangement conforms, in general, to accepted pharmacological teaching practice.

The tables, chemical formulas, and other illustrative material are concise and clear. They are most skillfully and advantageously used to highlight significant sections of the book. Recent advances in most of the specialized fields are adequately covered. The short selected bibliographic lists at the end of each section are very well chosen.

ACUTE RENAL FAILURE. By Arthur Grollman, M.D., Ph.D. Publication number 192, American Lecture Series, monograph in American Lectures in Internal Medicine, edited by Roscoe L. Pullen, M.D. Cloth. Price, \$4.00. Pp. 92, with illustrations. Charles C Thomas, Publisher, 301-327 E. Lawrence Ave., Springfield, Ill.; Blackwell Scientific Publications, 49 Broad St., Oxford, England; Ryerson Press, 299 Queen St. W., Toronto 2B, 1954.

Accomplishing what it sets out to do, this book acquaints the reader with the problems one faces in acute renal failure. The monograph is composed of five main chapters: Etiology, pathology, physiology, clinical course and treatment, and a well chosen up-to-date bibliography proves the quality of the publication.

The recent studies of Oliver are taken as the main source for presenting the histopathological lesions occurring in the tubules. It is further shown that the severity of the process as judged from renal function studies is determined apparently by the number of nephrons affected rather than by the severity of the damage, if this is limited to a few nephrons.

The clinical course is presented somewhat too concisely, but the therapeutic chapter is an excellent exposition of the most modern concept of treating acute renal insufficiency. The author shows clearly that the majority of patients can be managed well with conservative measures, and of these, he emphasizes: 1) The fat-carbohydrate oral mixtures containing forty per cent fat and ten per cent sugar, well tolerated when administered in small frequent doses; 2) regulation of potassium concentration in the serum because of the critical effects potassium changes induce in cardiac function, and 3) the uselessness in the majority of cases of correcting metabolic acidosis in the anuric period by administration of sodium bicarbonate or lactate, which can only result in an excess of extracellular sodium and resulting edema.

The new artificial measures of exchange transfusion, irrigation of the bowel, artificial kidney and peritoneal lavage are described in detail and the few indications for their use are properly presented.

The booklet is easily readable, the style is clear and concise and the typography is good. It should prove to be of considerable help to medical students, practitioners and specialists alike.

American Congress of Physical Medicine and Rehabilitation

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SECTION ON PM&R of Ohio State Medical Association will meet in Cincinnati on Wednesday, April 20, 1955.

Subjects and speakers are: "Physical Therapeutic Measures in the Diagnosis and Treatment of Peripheral Vascular Diseases," Louis G. Herrmann, M.D.; "Indications and Types of Orthopedic Surgery in Paralytic Poliomyelitis of the Upper Extremities," Joseph A. Freiberg, M.D.; "Fundamentals of Electromyography," Harry T. Zankel, M.D.; "Gait Training for the Hemiplegic," Mieczyslaw Peszczyński, M.D.

Complete details covering the meeting may be had by writing Herman J. Bearzy, M.D., Chairman, Section on Physical Medicine and Rehabilitation, Ohio State Medical Association, 134 Apple St., Dayton 9, Ohio.

ALPHABETIC INDEX OF MEMBERS OF THE
American Congress of Physical Medicine and Rehabilitation
American Society of Physical Medicine and Rehabilitation

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- Abramson, A. S., White Plains, N.Y.
 Adams, E. F., Warm Springs, Ga.
 Adamson, M. C., Edmonton, Alberta, Can.
 Aguilera, M. A., Guatemala City, Guatemala, C. A.
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 Allen, J. C., Hartford, Conn.
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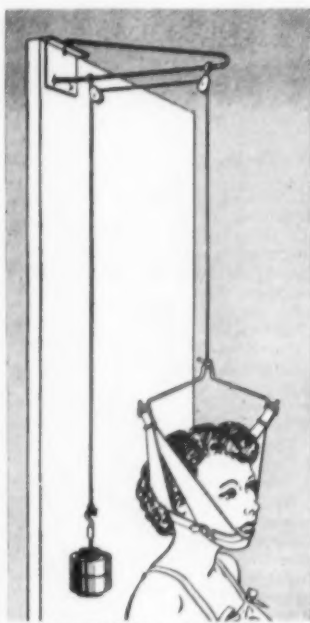
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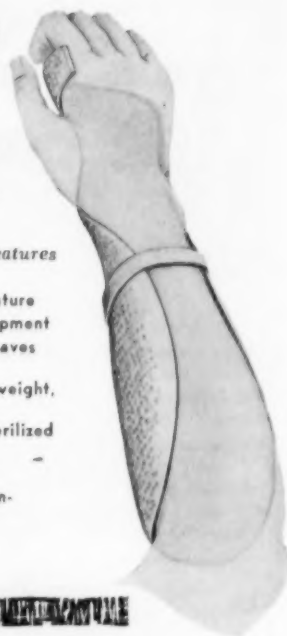
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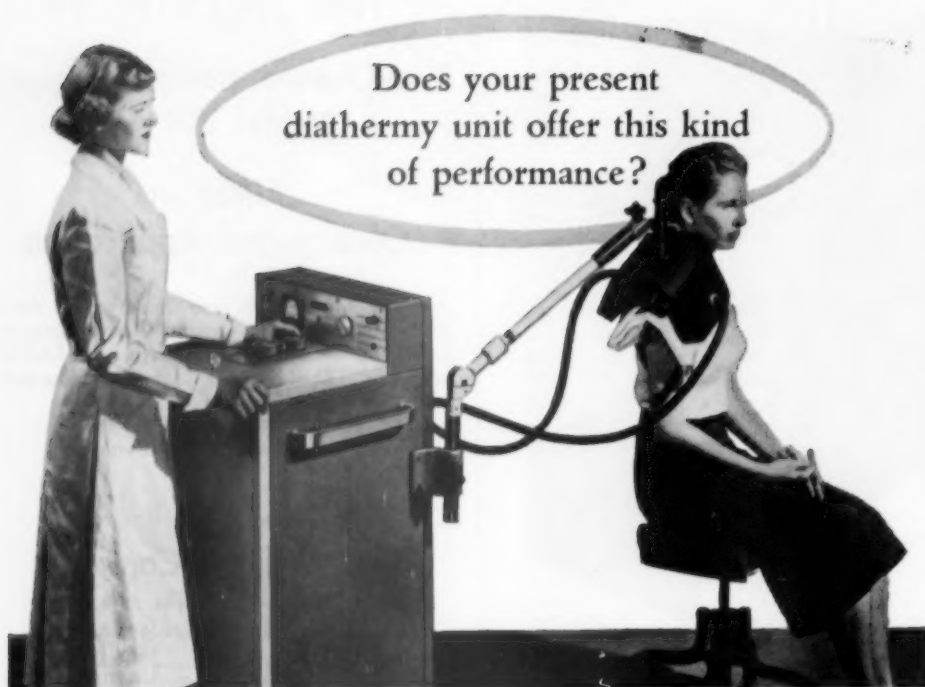
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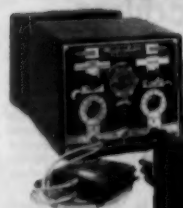
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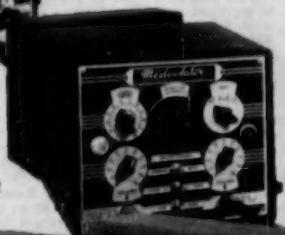
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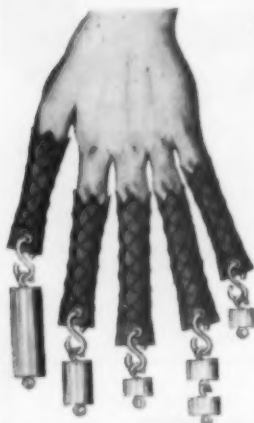
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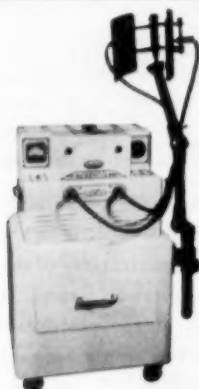
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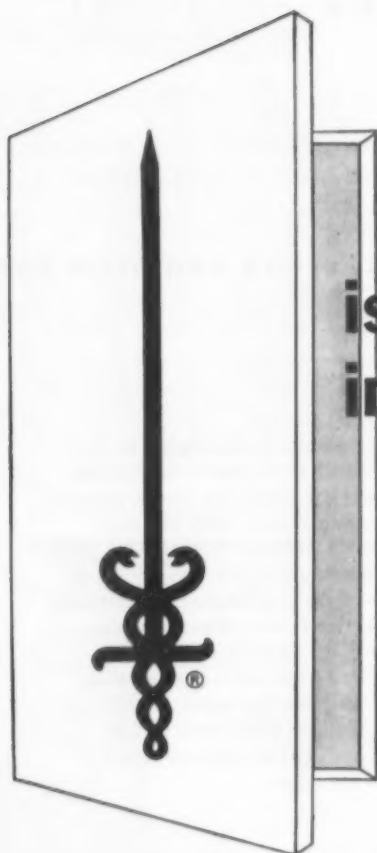
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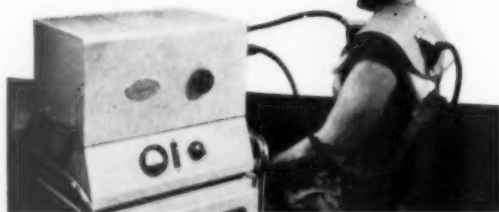
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To stimulate interest in the field of physical medicine and rehabilitation, the American Congress of Physical Medicine and Rehabilitation will award annually, a prize for an essay on any subject relating to physical medicine and rehabilitation. The contest, while open to anyone, is primarily directed to medical students, internes, residents, graduate students in the pre-clinical sciences and graduate students in physical medicine and rehabilitation. The Prize Lecture Committee suggests that members of the American Congress and American Society of Physical Medicine and Rehabilitation bring this announcement to the attention of interested persons. The following rules and regulations apply to the contest:

1. Any subject of interest or pertaining to the field of physical medicine and rehabilitation may be submitted.
2. Manuscripts **must be** in the office of the American Congress of Physical Medicine and Rehabilitation, 30 N. Michigan Ave., Chicago 2, not later than June 1, 1955.
3. Contributions will be accepted from medical students, internes, residents, graduate students in the pre-clinical sciences, and graduate students in physical medicine and rehabilitation.
4. The essay must not have been published previously.
5. The American Congress of Physical Medicine and Rehabilitation shall have the exclusive right to publish the winning essay in its official journal, the ARCHIVES OF PHYSICAL MEDICINE AND REHABILITATION.
6. Manuscripts must not exceed 3000 words (exclusive of headings, references, legends for cuts, tables, etc.), and the number of words should be stated on the title page. An original and one carbon copy of the manuscript must be submitted.
7. The winner shall receive a cash award of \$200, a gold medal properly engraved, a certificate of award and an invitation to present the contribution at the 33rd Annual Session of the American Congress of Physical Medicine and Rehabilitation at the Hotel Statler, Detroit, August 28-September 2, 1955.
8. The winner shall be determined by the Prize Lecture Committee composed of four members of the American Congress of Physical Medicine and Rehabilitation.
9. All manuscripts will be returned as soon as possible after the name of the winner is announced.
10. The American Congress of Physical Medicine and Rehabilitation reserves the right to make no award if, in the judgment of the Prize Lecture Committee, no contribution is acceptable. The Congress may also award certificates of merit to contributors whose essays may be considered second and third best submitted. Announcement of the winner will be made after the annual meeting.

#1000.00 Cash Award

The Birtcher Corporation will award the sum of \$1000, on or before February 1, 1956, to any physician presenting what a disinterested committee shall select as the best paper or book on the subject of "ULTRASONICS IN MEDICINE" during the year 1955. Physician-authors throughout the United States and Canada are eligible.

Papers:—Papers published in any professional medical journal are automatically considered as eligible.

(The Birtcher Corporation will endeavor to scan all medical publications and draw the attention of the selecting committee to each published paper, however, authors are requested to draw the attention of The Birtcher Corporation to any publication.)

Non-Published Papers:—A physician who has presented a paper on Ultrasonics to an organized medical group, but whose paper is not published in a medical journal, may submit a typewritten copy direct to The Birtcher Corporation giving presentation date and name of organized group to whom paper was presented.

Books:—Any book published covering the history, usage, medical philosophy, clinical reports, etc., of Ultrasonics in medicine will be considered as eligible.

Subject Matter of Papers:—A paper may report the use of Ultrasonic energy in clinical application in one case or an entire series, or may report laboratory investigations, or work on animals, which is significant in relation to Ultrasonics in the treatment of diseases in the human.

Selecting Committee:—All such material will be judged by a panel of three physicians, including a physiatrist and general practitioner. Material will be judged solely on the basis of its overall contribution to the medical profession in the use of Ultrasonics in medicine, not literary style. No staff member of The Birtcher Corporation or shareholder of said Corporation will serve on the judging committee, nor have his/her paper participate. The judgment of the committee will be final.

Announcement:—The winner will be announced in our advertisement in the February, 1956, issue of this journal. Cash award will be made by The Birtcher Corporation to the winner simply by depositing in the mails a \$1000 certified check. There are no strings attached. It is not necessary that the work reported in a given paper be accomplished through use of a Birtcher manufactured Ultrasonic device.

Purpose of The Award:—The overall purpose of this cash award is to promote the dissemination of information pertaining to the use of Ultrasonics and to stimulate the publication of papers on the subject of Ultrasonics in the field of medicine.

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